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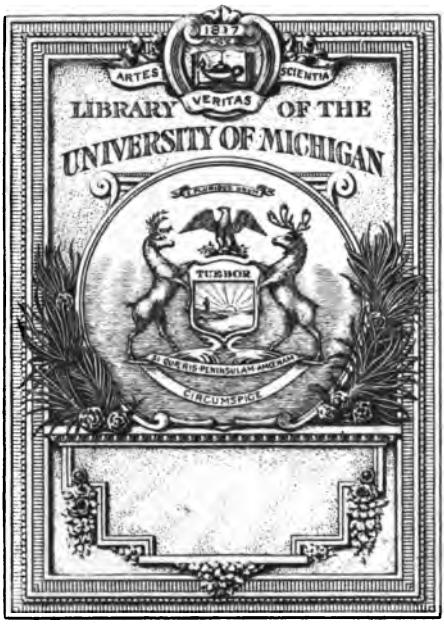
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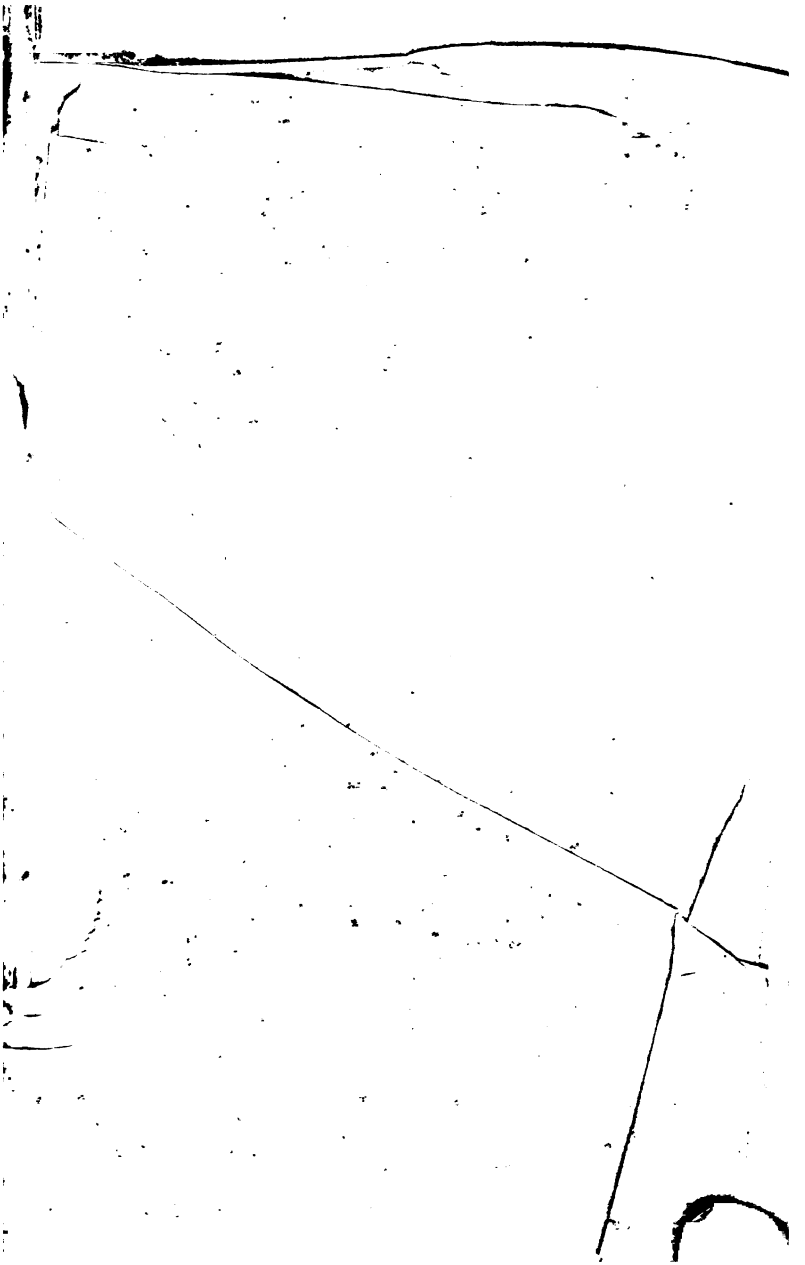

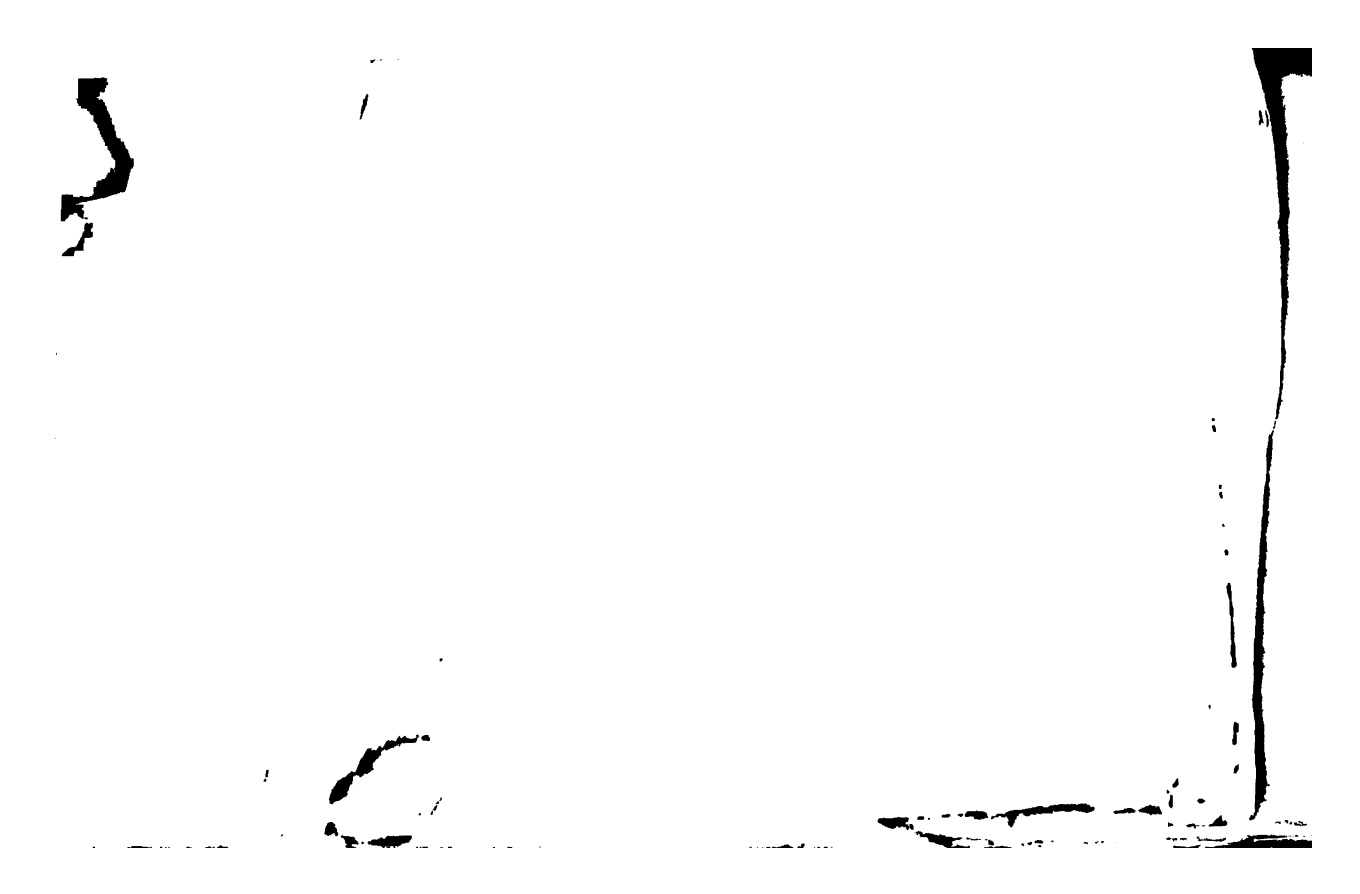

THE

PRIVATE INSTRUCTOR,

OR

MATHEMATICS SIMPLIFIED.

COMPRISING EVERY THING NECESSARY IN ARITHMETIC, BOOK-KEEPING, CONVEYANCING, MENSURATION, AND GUAGING, TO FORM AND COMPLETE THE MAN OF BUSINESS.

THE WHOLE UPON AN IMPROVED PLAN,

NOT ONLY ADAPTED TO PRIVATE INSTRUCTION, BUT ALSO TO

THE USE OF SCHOOLS.

"He that is ignorant of numbers is scarce half a man."
CHARLES XII, OF SWEDEN.

BY JASON M. MAHAN,
MATHEMATICIAN, NEW ITALY, CHESTER COUNTY, PENNSYLVANIA.

Harrisburg:
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PREFACE.

The following work has been in contemplation for a long time. Several years' experience as a teacher confirmed me in the opinion, that a work of this kind would be serviceable, particularly to such as are to receive but a small proportion of schooling. Its utility must be obvious to every one who considers that the opportunity for improvement with many is limited; and that many of the treatises on Arithmetic, Mensuration, &c. are not altogether calculated to give that instruction in so short a time as one intended for business ought to receive.

9-11-50 ADE

In order that the pupil may acquire a competent knowledge of the different branches, in as short a time and at as little expense as possible, I have carefully excluded all irrelevant matter, and have given only what I deemed necessary to prepare him for business. One of the most difficult questions in each rule is wrought out at full length, and by comparing these with the rules, which are laid down in a plain and familiar manner, any person who has the least knowledge of figures, or inclination to learn, may understand them, either with or without the aid of a teacher; so that the work is not only adapted to private instruction, but also to the use of schools.

With these impressions, and hoping that the work may be useful, it is now offered to the public, by

The public's most humble servant,

JASON M. MAHAN.

New Italy, January 2, 1839.

CONTENTS.

ARITHMETIC.

	Page.
Numeration,	9
Addition of Integers,	11
Subtraction of Integers,	14
Addition and Subtraction,	16
Multiplication of Integers,	18
Addition, Subtraction and Multiplication,	24
Division of Integers,	25
Long Division,	26
Decimal Fractions,	28
Addition of Decimals,	29
Subtraction of Decimals,	30
Multiplication of Decimals,	30
Reduction,	33
Federal *Money*,	58
Compound Addition,	59
Compound Subtraction,	67
Compound Multiplication,	74
Compound Division,	77
Reduction of Decimals,	78
Practical Questions,	83
Single Rule of Three,	86
Double Rule of Three,	91
Practice,	93
Questions for exercise,	95
Interest,	100
Rebate or Discount,	111
Bank Discount,	113
Extensive Addition,	116
Loss and Gain,	118
Barter,	120
Fellowship,	124
Exchange,	128
Custom-house allowances,	140
United States Duties,	143
Vulgar Fractions,	145
Reduction of Vulgar Fractions,	146
Addition of Vulgar Fractions,	155
Subtraction of Vulgar Fractions,	157
Multiplication of Vulgar Fractions,	158
Division of Vulgar Fractions,	159
The Single Rule of Three in Vulgar Fractions,	160
The Double Rule of Three in Vulgar Fractions,	161
Contracted Multiplication of Decimals,	162
Contracted Division of Decimals,	163
Contracted Division,	164
Equation of Payments,	166
Alligation,	171
Single Position,	175
Double Position,	177
Arithmetical Progression,	180
Geometrical Progression,	182
Involution,	184
Evolution,	185
Square Root,	185
Cube Root,	190
Duoedcimals,	192
Promiscuous Questions,	193

BOOK-KEEPING.

	P.
Day-Book,	201
Alphabet,	211
Ledger A,	212
Balancing,	217
Ledger B,	217

MERCANTILE FORMS.

Bills of Parcels,	218
Book Bill,	219
Bill of Lading,	219

CONVEYANCING.

Seaman's receipt,	222
Receipt in full of all demands,	222
for rent,	222
for money received of a third person,	222
for interest on a bond,	222
Common negotiable Note	223
Promissory Note,	223
Note with security,	223
Accommodation Note to Bank of U. States,	223
Forms and Directions for transacting business at the bank of Chester co.	224
Note with Interest,	227
Judgment Note,	227
Notice from Landlord to Tenant,	228
Proxy to vote for Directors of the Bank of the U. States,	228
Assignment of a bond or bill,	229
Common Judgment Bond	229
Assignment of a Bond,	230
For a Bond mislaid or lost	230
Indenture of an apprentice,	231
Assignment of an apprentice,	232
Lease of a Farm,	232
of a House,	233
Assignment of a Lease,	234
Agreement for sale of an Estate,	235
building a House,	236
with a Clerk or Workman,	237
Bill of Sale of Goods,	238
Letter of Attorney,	239
Letter of Attorney to receive debts,	241
Conditions of public vendue,	241
Sale of goods and chattels	242
Mortgage,	243
Deed,	244
Will,	247
Bond of Arbitration,	248
Award,	249
Petition for laying out a Road,	250
Return,	250
Petition for review of a Road,	251
Report,	251
Petition for vacating a Road,	252
Report,	252
Petition for valuing lands	253
Report,	253
Release from one to one,	253
of a Legacy,	254
to a Guardian,	254
for money received on a purchase,	255

MENSURATION.

	P.
Of the Square,	256
Of the Parallelogram,	257
Of the right-angled Triangle,	258
Of any Triangle,	259
Of the Trapezium,	260
Of regular Polygons,	261
Of the Circle,	263
Of the Oval or Ellipsis,	264
To measure the length of standing Timber,	265
Board Measure,	266
Of a Cube,	269
Of a Parallelopipedon,	269
Of a Cylinder,	270
Of a Cone,	270
Of a Globe or Sphere,	271
Ship's Tonnage,	272
Stone Measure,	273
To measure stone in a Well,	274
Paving and Plastering,	275
Shingle or Roof Measure	276
To find the side of a square piece of Timber, that may be hewn or sawed from a round piece,	276

MECHANICS.

Of the Lever,	277
Of the Wheel and Axle,	279
Of the Screw,	279

SPECIFIC GRAVITY.

Table of specific gravities	281
To find the specific gravity of a body,	282
To find the quantity of two ingredients in a given compound,	283
To ascertain whether spirituous liquors be above or below proof,	284
To find the pressure of water against a sluice or bank,	284

GUAGING.

To find the capacity of an oblong or square box, granary, &c.	285
of a cylindrical or circular vessel,	286
of a circular vessel, wider at one end than the other,	287
of a vessel whose bottom is hollowing, &c.	287
To find the content of a Still or Boiler,	288
Cask guaging,	290
Of the ullage of Casks,	292
To ullage a standing Cask,	294

GOLD COINAGE.

Table of Gold Coins,	296
To compute the fineness of Gold Coin,	300
Miscellaneous Questions,	301

EXPLANATION

Of the characters made use of in this work.

= The *sign of equality;* as 4 qrs. = 1 yard, signifies that 4 quarters are equal to one yard.

— *Minus*, or *less:* the sign of subtraction; as 8—2=6, that is, 8 lessened by 2 is equal to 6.

\+ *Plus* or *more:* the sign of addition; as 4+3=7, that is, 4 added to 3 is equal to 7.

× *Multiplied by:* the sign of multiplication; as 7×4=28, that is, 7 multiplied by 4 is equal to 28.

÷ *Divided by:* the sign of division; as 6÷2=3, that is, 6 divided by 2 is equal to 3.

$\frac{1728}{144}$. Numbers placed like a fraction do also denote division; the upper number being the dividend, and the lower the divisor.

:: So is; the sign of proportion; as 3 : 6 :: 2 : 4, that is, as 3 is to 6 so is 2 to 4.

$\overline{8-2+5}=11$, shows that the difference between 8 and 2 added to 5, is equal to 11.

$8-\overline{2+5}=1$, shows that the sum of 2 and 5 taken from 8, is equal to 1.

√ Prefixed to any number, signifies that the square root of that number is required.

∛ Signifies that the cube root is required.

The letters composing the words "my big horse," will in many places be substituted for figures. It will be easy to conceive each letter a figure, thus:

M	y	b	i	g	h	o	r	s	e
1	2	3	4	5	6	7	8	9	0

ARITHMETIC.

ARITHMETIC is that part of the mathematics which treats of numbers, and teaches how to apply them to useful purposes. It has five principal rules, on which all its operations depend, viz: *Notation* or *Numeration*, *Addition*, *Subtraction*, *Multiplication* and *Division*.

NUMERATION

Teaches the different value of figures by their different places, and to read and write any sum or number with the ten Arabic characters, called figures, or digits, viz: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

All numbers may be expressed by these figures.

THE TABLE.

Hundreds of millions.	Tens of millions.	Millions.	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.	
1	2	3	4	5	6	7	8	9,	123 millions, 456 thousand, 789.
	1	2	3	4	5	6	7	8,	12 millions, 345 thousand, 678.
		9	1	2	3	4	5	6,	9 millions, 123 thousand, 456.
			7	8	9	1	2	3,	789 thousand, 123.
				4	5	6	7	8,	45 thousand, 678.
					9	1	2	3,	9 thousand, 123.
						4	5	6,	four hundred and fifty-six.
							7	8,	seventy-eight.
								9,	nine.

The reading of numbers may be greatly facilitated, by dividing them into periods of three figures each; thus,

123,456,789, reads one hundred and twenty-three millions, four hundred and fifty-six thousand, seven hundred and eighty-nine.

Application.

Write down in proper figures the following numbers:

Nine, - - - - - - - - - - s.
Fifty-six, - - - - - - - - - gh.
Eight hundred and forty-three, - - - - rib.
Three hundred and five, - - - - - beg.
Six hundred and forty-one, - - - - - him.
Nine hundred and forty-eight, - - - - sir.
Three hundred, - - - - - - - bee.
Three hundred and seventy-two, - - - - boy.
Nine thousand six hundred and seventy, - - - shoe.
Eight thousand seven hundred and ninety, - - rose.
Nine thousand seven hundred and ten, - - - some.
Fifty-seven thousand seven hundred and ninety, - goose.
Nine hundred and sixty-two thousand, three hundred and seventy-two, - - - - - - shyboy.
Five hundred and seventy-seven millions, nine hundred thousand, five hundred and fifty-nine, gooseeggs.
Forty-eight millions, four hundred and ninety-six thousand, three hundred and seventy-two, irishboy.
One million, two hundred and sixty-seven thousand, eight hundred and ninety, - - - myhorse.

The following table, extending to nonillions, may sometimes be useful:

Nonillions,	Octillions,	Septillions,	Sextillions,	Quintillions,
628974,	587629,	719548,	327647,	591792,
Quadrillions,	**Trillions,**	**Billions,**	**Millions,**	**Units.**
514268,	438276,	951476,	679284,	151417.

NOTATION BY ROMAN LETTERS.

I. One.	XI. Eleven.
II. Two.	XII. Twelve.
III. Three.	XIII. Thirteen.
IV. Four.	XIV. Fourteen.
V. Five.	XV. Fifteen.
VI. Six.	XVI. Sixteen.
VII. Seven.	XVII. Seventeen.
VIII. Eight.	XVIII. Eighteen.
IX. Nine.	XIX. Nineteen.
X. Ten.	XX. Twenty.

XXX. Thirty.	CCCC. Four hundred.
XL. Forty.	D. Five hundred.
L. Fifty.	DC. Six hundred.
LX. Sixty.	DCC. Seven hundred.
LXX. Seventy.	DCCC. Eight hundred.
LXXX. Eighty.	DCCCC. Nine hundred.
XC. Ninety.	M. One thousand.
C. One hundred.	MDCCCXXXV. One thousand eight hundred and thirty-five.
CC. Two hundred.	
CCC. Three hundred.	

ADDITION OF INTEGERS.

ADDITION teaches to collect two or more numbers into one total sum.

RULE.

There must be a due regard had in placing the figures one under the other, that is, units under units, tens under tens, hundreds under hundreds, &c.; then begin at the right hand column, and add up each column successively and set down its amount; but if either of the amounts be ten or more, set down only its right hand figure, and add the number expressed by its left hand figure or figures to the next column; and so continue to the last column, at which set down the total amount.

Proof.—Perform the addition downwards; that is, begin at the top and add the figures downwards—and if the sum total be the same, it is right.

Examples.

2141	4123	125146
3212	3452	113834
1103	1215	106840
high	rose	bigrye
87625	21734	1230
147	52	216
3478	6478	22107
215	8682154	1001
55244	22664	78328
shoes	robbery	sorry

28271962	11264125	238146
1000001	2171003	21001
20012	10012	37
500103	5123100	146
18704294	39221815	390340
irishboy	gooseegg	hishoe

Practical Questions.

1. A testator bequeathed to his widow 3640 dollars, to his eldest son 3100 dollars, to three other sons each 2550 dollars, to his five daughters 1900 dollars each, to his executor 200 dollars, and left for charitable purposes 975 dollars. I desire to know the amount of the several bequests.

Dollars.	
3640	Bequeathed to the widow.
3100	" " eldest son.
2550	Three other sons.
2550	
2550	
1900	Five daughters.
1900	
1900	
1900	
1900	
200	Executor.
975	Charitable purposes.
25065	

2. A man born in the year 1797—when will he be 38 years of age? Ans. 1835.

3. A man lent his friend, at different times, these several sums, viz: 12 dollars, 91 dollars, 513 dollars, 9 dollars, 100 dollars, 69 dollars, and 721 dollars—How much did he lend in all? Ans. 1515.

4. Bought a parcel of goods, for which I paid 147 dollars; for packing, 3 dollars; carriage, 14 dollars—What do these goods stand me in? Ans. 164.

5. A. has due to him, on bond, 2159 dollars; on book accounts, 641 dollars; in sundry notes and due bills, 550 dollars, and in cash, 850 dollars. Required the amount due to him in all. Ans. 4200.

6. A. of West Chester, owes to B. of Philadelphia, for goods received in January, 112 dollars; for goods received in April, 296 dollars; for goods received in July, 341 dollars; for goods received in October, 176 dollars. I desire to know the amount of the whole bill. Ans. 925.

7. A gentleman left his elder daughter 1200 dollars more than the younger, and her fortune was 6000 dollars—What was the elder's fortune, and what did the father leave them?

Ans. Elder's, 7200; father left them, 13200.

8. Thomas has 25 apples, James double that number, and William as many as both—How many have they all?

Ans. 150.

9. An agent having been out with bills, brings home an account that A. paid him seven dollars, B. ninety-one dollars, C. sixty-four dollars, D. 79 dollars, E. twenty-six dollars, F. ninety-nine dollars, G. two hundred and forty dollars, and H. one hundred and eighty-nine dollars. I desire to know the whole amount. Ans. 795.

10. There are two numbers, the least whereof is 96; their difference 144—What is the greater number and sum of both? Ans. 240 greater; 336 sum.

11. A farmer raised in one season three hundred bushels of wheat, two hundred and sixty-five of rye, seven hundred and twenty-eight of oats, three hundred and eighty-seven of corn, one hundred and twenty-four of buckwheat, and one hundred and ninety-six of barley—How many bushels had he altogether? Ans. 2000.

12. Purchased 11 yards of cloth for seventy dollars, 15 yards of linen for nine dollars, 25 yards of silk for forty-seven dollars, 100 yards of muslin for thirteen dollars, 20 yards of cassinet for twenty-five dollars, and other goods to the amount of one hundred and sixty-four dollars—What is the amount of the whole? Ans. 328.

13. If I buy, at one time, twelve acres of land for 312 dollars; at another, five acres for 300 dollars; at a third, seven acres for 210 dollars; at a fourth, nine acres for 198 dollars; at a fifth, six acres for 72 dollars; at a sixth, twelve acres for 336 dollars; and expend for building, 4728 dollars—How many acres have I, what is the cost of the land alone, also the cost including the building?

Ans. 49 acres; 1422 cost of the land alone; 6150 cost including the building.

14. A gentleman had a service of plate, which consisted of eighteen dishes, weighing 10 pounds; forty plates, weighing 23 pounds; three dozen spoons, weighing seven pounds; five salts and five pepper boxes, weighing 4 pounds; knives and forks, weighing 5 pounds; three large cups, a tankard and a mug, weighing 10 pounds; a tea kettle, weighing 7 pounds; together with several other small articles, weighing 12 pounds. I desire to know the weight of the whole. Ans. 78.

SUBTRACTION OF INTEGERS.

SUBTRACTION teaches to take a less number from a greater, and shows the remainder or difference.

RULE.

Place the smaller quantity under the larger—units under units, tens under tens, &c.—as in addition; then begin at the right hand figures, and if the under figure be less than the upper, take the difference and set it down; take each difference successively, but if any of the under figures be greater than the upper, then take it from ten, and add the upper figure to this difference, observing to add one to the next under figure; and thus proceed to the end.

Proof.—Add the remainder and less line together, and (if right) the sum will be the same as the greater number.

Examples.

From	764973	48276549	4917627943
Take	142651	13762715	4162791574
Rem.	622322	34513834	754836369
Proof,	764973	48276519	4917627943

75762915	10000000	20000000
147623	9715843	19999999

Application.

1. A horse in his harness is worth one hundred and forty dollars; out of it, one hundred and fifteen dollars. I desire to know how much the horse is worth more than the harness.

Dolls.
140 Value of the horse and harness.
115 Value of the horse alone.

25 Value of the harness alone.

115 Value of the horse.
25 Value of the harness.

90 Ans. The horse worth more than the harness.

2. A man born in the year 1797, what is his age in the year 1837? Ans. 40 years.

3. What is the difference in the ages of a man born in 1793, and another born in 1823? Ans. 30 years.

4. A gentleman dying, left 5864 dollars between two daughters: the youngest was to have 2932 dollars—What was the elder's share? Ans. $2932.

6. The mariner's compass was invented about the year 1302—How long has it been invented, counting to the year 1837? Ans. 533 years.

7. If a man have two thousand seven hundred and forty-one acres of land, and sell one thousand nine hundred and ninety-nine acres—how many acres has he left? Ans. 742.

8. If a man have, in cash, six thousand seven hundred and twenty-five dollars, and pay sundry debts amounting to two thousand two hundred and ninety-four dollars—How much has he left? Ans. 4431 dollars.

9. Bought forty-five barrels of flour for two hundred and seventy dollars, and sold twenty-one barrels for one hundred and forty-seven dollars—How many barrels have I left, and how much do they stand me in?
Ans. 24 barrels, and stand me in 123 dollars.

10. A's annual income is six hundred and twenty-five dollars, and B's four hundred and seventy dollars—How much is A's more than B's? Ans. 155 dollars.

11. A. travels westward one thousand eight hundred and thirty miles; B. sets out from the same place, and follows in the same direction one thousand seven hundred and ninety-seven miles—How many miles are they apart? Ans. 33.

12. Sold goods for seven hundred and twenty-seven dollars, which cost me eight hundred and fourteen dollars—How many dollars did I lose by the sale? Ans. 87.

13. What is the difference between nine thousand, and nine hundred? Ans. 8100.

14. America was discovered in the year 1492, by Christopher Columbus; and American Independence was declared in 1776. I wish to know the number of years between these two events. Ans. 284.

15. A vintner bought 31 pipes of brandy, containing 3746 gallons; and sold 19 pipes, containing 2294 gallons—How many pipes and gallons were left? Ans. 12 pipes, 1452 gals.

16. It is said that on the 19th day of June, 1835, a tornado passed near Gravel Hill, Warren county, New Jersey, which prostrated all the apple trees, in an orchard containing three hundred trees, except four or five. I desire to know how many there were prostrated. Ans. 295 or 296.

ADDITION AND SUBTRACTION.

1. A tradesman, happening to fail in business, called all his creditors together, and found he owed to A. 75 dollars, to B. 140 dollars, to C. 64 dollars, to D. 95 dollars, to E. 72 dollars, to F. 27 dollars, to G. 55 dollars, and to H. 92 dollars. His creditors found the value of his stock to be two hundred dollars; recoverable book debts, 112 dollars; besides money on hand, 134 dollars. I desire to know whether they were gainers or losers, and how much?

	Dolls.		Dolls.
Owing to A.	75	Value of stock,	200
To B.	140	Book debts,	112
To C.	64	Money,	134
To D.	95		
To E.	72		446
To F.	27		
To G.	55		
To H.	92		
Whole am't of debt,	620		
Am't of his effects,	446		
Creditors lose,	174	Answer.	

2. A man setting out on a journey of 976 miles, travels the first day 52 miles; the second, 50 miles; the third, 61 miles; the fourth, 49 miles; the fifth, 56 miles; the sixth, seventh, eighth, ninth and tenth days, each, 55 miles—How far is he from his journey's end? Ans. 433 miles.

3. A merchant, at his outsetting in trade, owed 1200 dollars: he had in cash, 600 dollars; good debts, 1150 dollars: he cleared the first year, by commerce, 1000 dollars—What is the neat balance at the twelve months' end?

Ans. 1550 dollars.

4. A farmer has 5 granaries of wheat, containing 576 bushels: one contains 104 bushels; another, 79 bushels; a third, 85 bushels; a fourth, 159 bushels—How many bushels does the fifth contain? Ans. 149.

5. Sent a servant to market to purchase vegetables: he laid out for radishes, 12 cents; for onions, 9 cents; for asparagus, 16 cents; for potatoes, 14 cents, and for lettuce, 19 cents—How much change should he return, 90 cents being the amount he took with him? Ans. 20 cents.

6. A farm of one hundred acres is divided, as follows, viz: 12 acres of wheat, 5 of rye, 17 of corn, 16 of oats, 1 of potatoes, 16 of grass, 12 of barley, 1 of flax; the orchard, garden and buildings, occupy 16 acres; the remainder is woodland—How much is there of it? Ans. 4 acres.

7. Bought of A. 1000 bushels oats; of B. twice as much: of which were sold to C. 500 bushels; to D. twice as much, and to E. as much as to them both—How much have I on hand? Ans. None.

8. A gentleman, having a farm of one hundred and ten acres, purchased one adjoining, containing one hundred and fifty-seven acres; which at his decease he bequeathed to his three sons—to Thomas, seventy-five acres; to Edmund, ninety-eight acres, and the remainder to Gilbert—How many acres fell to Gilbert's share? Ans. 94.

MULTIPLICATION OF INTEGERS.

MULTIPLICATION is the multiplying of any two numbers together, and compendiously performs the office of many additions.

To this rule belong three principal members, viz:

1. The multiplicand, or number to be multiplied;
2. The multiplier, or number to multiply by;
3. The product, or number produced by multiplying.

RULE.

Set down the multiplicand, place the multiplier under it, and draw a line under them. Then begin with the right hand figure, and with it multiply the unit figure in the multiplicand; set down its product; proceed in this way with each figure; but if either of the products be ten or more, set down only the number expressed by its right hand figure, and add the number expressed by its left hand figure or figures to the product of the next figure; and so continue to the last, where the whole product must be set down. The multiplicand and multiplier are called factors.

Proof.—Multiplication may be proved by inverting the factors. There is however a more compendious, but less accurate mode, that is, by casting out the nines from the multiplicand and multiplier, the remainders put on each side of a cross; multiply the figures on each side together, cast the nines from the product, and put the overplus at top; then cast out the nines from the product of the multiplication, and place its remainder at the bottom of the cross; if it be the same as the top, the work is supposed to be right. But the former mode is the surest.

MULTIPLICATION TABLE.

Twice		3 times		4 times		5 times		6 times		7 times	
1 are	2	1 are	3	1 are	4	1 are	5	1 are	6	1 are	7
2	4	2	6	2	8	2	10	2	12	2	14
3	6	3	9	3	12	3	15	3	18	3	21
4	8	4	12	4	16	4	20	4	24	4	28
5	10	5	15	5	20	5	25	5	30	5	35
6	12	6	18	6	24	6	30	6	36	6	42
7	14	7	21	7	28	7	35	7	42	7	49
8	16	8	24	8	32	8	40	8	48	8	56
9	18	9	27	9	36	9	45	9	54	9	63
10	20	10	30	10	40	10	50	10	60	10	70
11	22	11	33	11	44	11	55	11	66	11	77
12	24	12	36	12	48	12	60	12	72	12	84

Multiplication Table—Continued.

8 times		9 times		10 times		11 times		12 times	
1 are	8	1 are	9	1 are	10	1 are	11	1 are	12
2	16	2	18	2	20	2	22	2	24
3	24	3	27	3	30	3	33	3	36
4	32	4	36	4	40	4	44	4	48
5	40	5	45	5	50	5	55	5	60
6	48	6	54	6	60	6	66	6	72
7	56	7	63	7	70	7	77	7	84
8	64	8	72	8	80	8	88	8	96
9	72	9	81	9	90	9	99	9	108
10	80	10	90	10	100	10	110	10	120
11	88	11	99	11	110	11	121	11	132
12	96	12	108	12	120	12	132	12	144

Examples.

1. Multiply 97627354 by 9.

Thus, 97627354
9

878646186

Explanation.—Here I say 9 times 4 are 36: I put down 6 and carry 3; saying 9 times 5 are 45, and 3, that I carried, make 48: I put down 8 and carry 4; then I say 9 times 3 are 27, and 4, that I carried, make 31: I put down 1 and carry 3; I then say 9 times 7 are 63, and 3, that I carried, are 66: I put down 6 and carry 6; then I say 9 times 2 are 18, and 6, that I carried, are 24: I put down 4 and carry 2; then I say 9 times 6 are 54, and 2, that I carried, make 56: I put down 6 and carry 5; then I say 9 times 7 are 63, and 5, that I carried, make 68: I put down 8 and carry 6; I then say 9 times 9 are 81, and 6, that I carried, make 87: and here I set down the full product.

2. Multiply 123422 by 12.

Thus, 123422
12

1481064

Proof, by the cross, and explanation:

I commence with the right hand figure of the multiplicand, and say 2 and 2 are 4, and 4 are 8, and 3 are 11. I cast 9

from this, and 2 are left, which I add to the two remaining figures, which makes five. I set down this on the left hand of the cross; then I add together the figures in the multiplier, and find they amount to only 3. I put this down on the right hand of the cross. I then multiply these two figures together, saying 3 times 5 are 15. I cast 9 from this, and 6 are left: I put this down at the top of the cross. Then I add the figures of the product, thus—I say 4 and 6 are 10; I cast 9 from this, and 1 is left. I then say 1 and 1 are 2, and 8 are 10: here I cast away 9 again, and 1 is left. I then say 1 and 4 are 5, and 1 are 6, which is the same as the top figure—the work is, therefore, presumed to be right.

Examples.

41232314	71536714	15976273845
2	3	4
82464628	214610142	63905095380
319567843	719629735	51483726791
5	6	7
9762971543	71479627951	3271468974
8	9	10
7627915435	271541793	7154276
11	12	12

When the multiplier is more than 12, and less than 20, multiply by the unit figure of the multiplier, adding to the product the back figure to that you multiplied.

981573214	271876297	3715427143
13	14	15
12760451782		
7962971435	719782154	5143715471
16	17	18

When there are several figures in the multiplier, there must be as many products as figures in the multiplier—observing to place the first figure of every product under the figure you multiply by. Add the several products together, and their sum will be the total product.

1. Multiply 4917678291 by 547964.

Thus, 4917678291 Multiplicand.
547964 Multiplier.

19670713164
29506069746
44259104619
34423748037
19670713164
24588391455

2694710667049524 Product.

2. Multiply 25362 by 13. Product, 29706.
3. " 5127 by 19. " 97413.
4. " 71526 by 25. " 1788150.
5. " 194 by 47. " 9118.
6. " 5372 by 75. " 402900.
7. " 958 by 93. " 89094.
8. " 15927 by 104. " 1656408.
9. " 795 by 195. " 155025.
10. " 67 by 241. " 16147.
11. " 1005 by 376. " 377880.
12. " 957 by 579. " 554103.
13. " 2007 by 1008. " 2023056.
14. " 99999 by 9999, " 999890001.

When ciphers occur between the significant figures in the multiplier, they may be omitted in the operation; but great care must be taken that the next figure must be as many figures farther to the left hand, that is, under the figure you multiply by.

1. Multiply 400908 by 60008.

Thus, 400908 Multiplicand.
60008 Multiplier.

3207264
2405448

24057687264 Product.

2.	Multiply	51428	by	206.	Product,	10594168.
3.	"	6147	by	5007.	"	30778029.
4.	"	52764	by	1006.	"	53080584.
5.	"	1375	by	3005.	"	4131875.
6.	"	217405	by	2104.	"	457420120.
7.	"	37196	by	10005.	"	372145980.
8.	"	157928	by	2003.	"	316329784.
9.	"	7184276	by	104.	"	747164704.
10.	"	51439	by	2009.	"	103340951.
11.	"	218743	by	7003.	"	1531857229.
12.	"	1597642	by	607.	"	969768694.

When there are ciphers at the end of the multiplicand or multiplier, they may be omitted in the operation. Multiply by the rest of the figures, and set down the right hand of the total product as many ciphers as were omitted.

1. Multiply 39400 by 672000.

Thus, 39400 Multiplicand.
672000 Multiplier.

788
2758
2364

26476800000 Product.

2.	Multiply	9400	by	130.	Product,	1222000.
3.	"	13000	by	4500.	"	58500000.
4.	"	4100	by	1530.	"	6273000.
5.	"	310	by	98000.	"	30380000.
6.	"	5400	by	6500.	"	35100000.
7.	"	21500	by	7200.	"	154800000.
8.	"	70500	by	460.	"	32430000.
9.	"	49000	by	40.	"	1960000.

When the multiplier is the exact product of two factors in the multiplication table, then multiply by one of those factors; and that product, multiplied by the other factor, will give the answer.

1. Multiply 4793 by 42.

Thus, 4793
$7 \times 6 = 42$.

33551
6

201306 Product.

2.	Multiply	5194	by	18.	Product,	93492.
3.	"	6271	by	21.	"	131691.
4.	"	762	by	24.	"	18288.
5.	"	9147	by	27.	"	246969.
6.	"	5292	by	32.	"	166144.
7.	"	479	by	36.	"	17244.
8.	"	1420	by	42.	"	59640.
9.	"	547	by	44.	"	24068.
10.	"	2749	by	54.	"	148446.
11.	"	1981	by	64.	"	126784.
12.	"	21763	by	72.	"	1566936.
13.	"	7169	by	108.	"	774252.
14.	"	279	by	121.	"	33759.
15.	"	1526	by	144.	"	219744.

Application.

1. What sum must be divided among 12 men, so that each man may receive 27 dollars?

Dols.
27
12
—
324 Answer.

2. A tradesman gave to his daughter, as a marriage portion, a scrutoire, in which were 12 drawers; in each drawer were 4 divisions; in each division were 10 purses; in each purse 50 dollars—How much had she to her fortune?

12 Drawers.
4
—
48 Divisions.
10
—
480 Purses.
50
—
24000 Dollars.

3. What will 27 cords of wood come to at 5 dollars per cord. Ans. 135 dolls.

4. What is the product of 6742 multiplied by 241? Ans. 1624822.

5. Suppose 25 men were concerned in the payment of a debt, and each man paid 547 dollars—How much was the debt? Ans. 13675 dolls.

6. Admit an orchard consisting of 41 trees one way, and 37 the other—How many trees in said orchard? Ans. 1517.

7. Bought 16 bales of linen; in each bale 43 pieces; in each piece 19 yards—How many pieces and yards were therein? Ans. 688 pieces; 13072 yards.

8. A quantity of rails was hauled at 96 loads; each load 104 rails—How many were there? Ans. 9984.

ADDITION, SUBTRACTION AND MULTIPLICATION.

1. The less of two numbers is 45; their difference 16. If 28 times 98 be subtracted from the product, how many are left?

45	Less number.	98
16	Difference.	28
61	Greater number.	784
45	Less number.	196
305		2744
244		
2745	Product.	
2744	Product of 28 times 98.	
1	Answer.	

2. In an army, consisting of 84 squadrons of horse, each 131 men; and 112 battalions, each 798 men—How many effective soldiers, supposing that in 5 hospitals there are 380 sick? Ans. 100000.

3. A gentleman, at his decease, left his widow 3000 dollars. He bequeathed 405 dollars to each of his four nephews; 375 dollars to each of his five nieces; to 7 poor families 75 dollars each; and to his executor 305 dollars. Now, on the sale of his effects, the amount received was found insufficient to answer these legacies, by 100 dollars—What sum must he have been possessed of at the time of his death? Ans. 7225 dolls.

DIVISION OF INTEGERS.

DIVISION teaches to find how often one number is contained in another, or to divide any number into what parts you choose. It consists of four parts, viz:

1st, The dividend, or number to be divided;

2d, The divisor, or number to be divide by;

3d, The quotient, or number sought;

4th, The remainder, if any, which must be less than the divisor.

SHORT DIVISION.

SHORT DIVISION is that in which the divisor does not exceed 12.

RULE.

Find how often the first figure or figures contains the divisor, under which place the result: the remainder (if any) conceive to be prefixed to the next figure. Find how often these contain the divisor, and so proceed.

Proof.—Multiply the divisor and quotient together, adding the remainder, if any; and the product will be the same as the dividend.

Examples.

Divisor,	2)24862	3)712194	4)61278940
Quotient,	12431	237398	15319735
	2	3	4
Proof,	24862	712194	61278940

5)7129714 6)3213645 7)9827931

8)8271984 9)71589743 10)19762754

11)21796871 12)32719654 12)71962715

If any two numbers, being multiplied together, are exactly equal to the divisor, then, by dividing the dividend by one of said numbers, and that quotient by the other number, it will

give the quotient required. But as it sometimes happens that there is a remainder to each of the quotients, and neither of them the true one, therefore, to find the true remainder, multiply the first divisor by the last remainder; to that product add the first remainder, which will give the true one.

Examples.

1. Divide 9327 by 108.

Here $12 \times 9 = 108$

Then, $9)9327$

$12)1036 + 3$

$86 + 4$

Here is 3 for the first remainder, and 4 for the second; then say 9 times 4 are 36, and 3 are 39, the true remainder.

2.	Divide	9438	by	24.	Quotient,	393,	Remainder,	6.
3.	"	617	by	32.	"	19,	"	9.
4.	"	7948	by	42.	"	189,	"	10.
5.	"	19762	by	56.	"	352,	"	50.
6.	"	21958	by	60.	"	365,	"	58.
7.	"	9872	by	70.	"	141,	"	2.
8.	"	719623	by	84.	"	8566,	"	79.
9.	"	217167	by	110.	"	1974,	"	27.
10.	"	718325	by	121.	"	5936,	"	69.
11.	"	627196	by	144.	"	4355,	"	76.

LONG DIVISION.

LONG DIVISION is that wherein the divisor exceeds 12.

RULE.

For the first dividual take as many of the first figures of the dividend as will contain the divisor: seek how often the divisor is contained therein. Set the result down for the first quotient figure; multiply this figure into the divisor; subtract the product from the dividual; annex the next figure of the dividend to this remainder, which will be the second dividual —and so proceed until all the figures are used.

Proof—As in Short Division.

Examples.

1. Divide 6197348 by 191.

Thus, 191)6197348(32446 Quotient.
573
467
382
853
764
894
764
1308
1146
162 Remainder.

2. Divide 6471235427 by 4792753. Quot. 1350, Rem. 1018877.
3. " 71826 by 964. " 74, " 490.
4. " 2197163 by 7612. " 288, " 4907.
5. " 574315 by 2148. " 267, " 799.
6. " 7162769 by 76. " 94246, " 78.
7. " 543795 by 987. " 550, " 945.
8. " 6437 by 2003. " 3, " 428.
9. " 9999 by 99. " 101.

When there are one or more ciphers on the right of the divisor, omit them in the operation, separating from the right of the dividend as many figures, which must be annexed to the remainder.

1. Divide 76420000 by 9500.

Thus, 95,00)764200,00(8044 Quotient.
760
420
380
400
380
2000 Remainder.

2. Divide 742186 by 61000. Quotient 12, Remainder 10186.
3. " 9162 by 140. " 65, " 62.
4. " 7436 by 570. " 13, " 26.
5. " 98271 by 1600. " 61, " 671.
6. " 47219 by 45000. " 1, " 2219.

Application.

1. Sold 93 acres of land, for 2883 dollars—How many dollars was it per acre? Ans. 31.

Dolls.
93)2883(31 Answer.
279
—
93
93
—

2. Bought 19 cords of wood, for 57 dollars—What was it per cord? Ans. 3 dolls.
3. How many barrels of flour can I buy for 594 dollars, at 6 dollars a barrel? Ans. 99.
4. If 27 men have 648 dollars, what is it a piece? Ans. 24 dolls.
5. Sold a quantity of hay for 143 dollars, at 11 dollars per ton: I desire to know how many tons there were? Ans. 13.
6. If a man spend 216 dollars in a year, what is it per month? Ans. 18 dolls.
7. A gentleman has a garden, containing 9600 square feet; the breadth is 80 feet—What is the length? Ans. 120 feet.
8. What is the value of one thousand shingles, when 25 thousand are sold for 200 dollars? Ans. 8 dolls.
9. A prize of 5184 dollars is to be divided equally among 432 sailors—What is each man's share? Ans. 12 dolls.
10. Divide 75 dollars equally between Tom, Dick and Harry, and tell each one's share? Ans. 25 dolls.
11. Sold 14 hundred weight of bacon, for 84 dollars: I desire to know how much it was per hundred? Ans. 6 dolls.

DECIMAL FRACTIONS.

A DECIMAL FRACTION is a part or parts of a unit, varies in the same proportion, and is managed by the same method of

operation, as a whole number: it is denoted by a point prefixed to a figure or figures, thus, .7, .78, .789. The first figure denotes so many tenths of a unit; the second, so many hundredths of a unit; the third, so many thousandths of a unit. And as whole numbers, reckoned from right to left, increase in a tenfold proportion, so decimals, reckoned from left to right, decrease in a tenfold proportion: thus, .7 = seven-tenths; .07 = seven-hundredths; .007 = seven-thousandths.

Ciphers annexed to decimals, neither increase nor decrease their value: thus, .7000 and .7 are equal.

ADDITION OF DECIMALS.

Rule.

Place the numbers according to their value, viz: units under units, tenths under tenths, &c.: then begin at the right hand, and add them up as in addition of integers. Be careful to put the point in the sum total exactly under those in the example.

Examples.

Acres.	Dollars.
27.1	971.125
19.62	12.16
3.147	109.007
15.0274	16.1145
64.546	243.12
17.4	96.143
146.8404	1447.6695

Note.—Cents are decimal parts of a dollar.

Application.

1. Borrowed at one time 574 dollars; at another, sixty dollars and ninety-seven cents; at a third, eighty-seven cents. What sum did I borrow in all?

Dolls.
574.
60.97
.87
635.84 Answer.

2. Add 57.6, 93.741, 64.104, 5.1814, together, and tell the amount. Ans. 220.6264.

SUBTRACTION OF DECIMALS.

RULE.

Place the numbers as in addition, with the less under the greater. Begin at the right hand, and subtract as in integers; and set the point in the remainder directly under those in the example.

Examples.

	Dolls.	Yards.	Acres.
From	513.49	126.4974	576.159
Take	27.16	17.143	31.27843
	486.33	109.3544	544.88057

1. From 70.41 take 16.42, and tell what is left.
Ans. 53.99.

2. Borrowed two hundred dollars, and paid one hundred and eighty-seven dollars and sixty-four cents—How much do I yet owe? Ans. 12.36 dolls.

3. Deposited in bank one thousand dollars; and having drawn checks to the amount of six hundred and twenty dollars and seventy-four cents—I demand what sum I have in bank. Ans. 379.26 dolls.

MULTIPLICATION OF DECIMALS.

RULE.

Place the factors, and multiply them as in whole numbers; and from the product towards the right hand cut off as many places for decimals as there are in both factors together; but if there should not be so many places in the product, supply the defect with ciphers to the left hand.

Examples.

1. Multiply 54328.716275 by .1235.

Thus, 54328.716275
.1235

271643581375
162986148825
108657432550
54328716275

6709.5964599625 Product.

2.	Mult'y	89.6785	by	92.6	Prod't,	3673.7661
3.	"	.31739	by	.4132	"	.131145548
4.	"	.785398	by	105.4876	"	82.8497500648
5.	"	.7	by	.12	"	.084
6.	"	.32	by	.11	"	.0352
7.	"	1.47	by	.3	"	.441
8.	"	.07	by	.1436	"	.010052
9.	"	2.31	by	.0024	"	.005544
10.	"	.0005	by	00004.	"	.00000002

DIVISION OF DECIMALS.

Division of decimals is also worked as whole numbers: the only difficulty is in valuing the quotient, which is done by the following

RULE.

When the dividend has not as many decimal places as the divisor, or will not contain it, annex ciphers to supply the defect; then divide as in integers. The first figure in the quotient will be of the same value with that figure of the dividend which answers or stands over the place of units in the divisor: the quotient will also have so many decimal places as the dividend has more than the divisor.

Examples.

1. Divide 71623.5127169 by 2315.4169.

Thus, 2315.4169)71623.5127169(30.933 Quotient.
69462 507

2161.00571
2083 87521

77 130506
69 462507

7 6679999
6 9462507

.7217492 Remainder.

Here the ten's figure in the dividend stands over the unit's figure of the divisor; therefore the first figure of the quotient is a ten's figure, or the quotient may be valued by the latter part of the rule, viz: there are seven decimal figures in the

dividend, and four in the divisor; there are then three more decimal figures in the dividend than the divisor, and therefore there must be three decimal figures in the quotient.

The last figure of the remainder is of the same value with the last figure of the dividend.

2. Divide 42.1615 by 12.04.

Thus, 12.04)42.1615(3.5017 Quotient.
36 12

6 041
6 020

2150
1204

9460
8428

.001032

Here, in the third place, the dividual did not contain the divisor, and a cipher was annexed, as was also the case in the fourth place. When cases of this kind occur, the ciphers annexed must be counted with those contained in the dividend, and the quotient valued accordingly.

3.	Divide	71.429	by	1.716.	Quot.	41.625, Rem. .0005
4.	"	8.2533	by	6.71	"	1.23
5.	"	28	by	112.	"	.25
6.	"	5	by	.5	"	.1
7.	"	.5	by	5.	"	.1
8.	"	25	by	.5	"	50
9.	"	5	by	.25	"	20
10.	"	.412335	by	539	"	.000765.

When numbers are to be divided by 10, 100, 1000, 10000, &c., it is performed by placing the separating point in the dividend so many places towards the left hand as there are ciphers in the divisor.

Thus, 6791 ÷ 10 = 679.1 5443 ÷ 100 = 54.43

9746.21 ÷ 1000 = 9.74621 17143.2 ÷ 10000 = 1.71432

REDUCTION.

Reduction teaches to reduce money, weights, measures, &c., from one denomination to another, without changing the value. When greater names are to be brought to less, it is called Reduction descending; but when less names are to be brought into greater, it is called Reduction ascending.

Rule.

When greater names are to be brought to less, multiply by as many of the less as make one of the greater denomination, adding into the product the numbers of the less, if any. But when less names are to be brought into greater, divide by as many of the less as make one of the greater denomination.

WEIGHTS AND MEASURES.

The following act, it is presumed, will not be amiss in this place.

AN ACT

To fix the Standards and Denominations of Measures and Weights in the Commonwealth of Pennsylvania.

Section 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same, That the standard unit of all measures of length shall be the yard, to conform to that in use in this Commonwealth at the date of the Declaration of Independence, the positive standard to be obtained as hereinafter described; and that one-third of said yard shall be one foot, and that one-twelfth of said foot shall be one inch.

Section 2. The standard of liquid measure shall be the gallon, to contain two hundred and thirty-one cubic inches, of the standard aforesaid, and no more; and that the standard of dry measure shall be the bushel, to contain two thousand one hundred and fifty cubic inches and forty-two-hundredths of a cubic inch, of the standard aforesaid, and no more.

Section 3. The standard weight shall be a pound, to be computed upon the Troy pound of the mint of the United States, referred to in the act of Congress of the nineteenth of May, one thousand eight hundred and twenty-eight, to wit:

the Troy pound of this Commonwealth shall be equal to the Troy pound of the mint aforesaid; and the avoirdupois pound of this Commonwealth shall be greater than the Troy pound aforesaid, in the proportion of seven thousand to five thousand seven hundred and sixty.

Section 4. It shall be the duty of the Governor of this Commonwealth, to procure, within three years from the date of the passage of this act, a standard yard, to constitute the positive standard of length in this Commonwealth; said standard to be equal in length, at the temperature of melting ice, to the distance between the eleventh and forty-seventh inches on a certain brass scale of eighty-two inches in length, procured for the survey of the coast of the United States, and now deposited in the War Department: the material of said standard to be brass, and the divisions upon it to be inches and parts of an inch, of the brass scale aforesaid.

Section 5. It shall be the duty of the Governor, to procure, within three years after the passage of this act, for the use of this Commonwealth, a standard gallon and bushel, to conform to the provision of section second of this act: the material of said standard to be of cast brass.

Section 6. It shall be the duty of the Governor of this Commonwealth, to procure, within three years after the passage of this act, a duly authenticated copy of the Troy pound of the mint of the United States, to constitute the positive standard of weight of this Commonwealth: the material of said standard to be brass.

Section 7. It shall be the duty of the Governor of this Commonwealth, to have the positive standards of measures of length and capacity, and of weight, provided by the foregoing sections, inclosed in suitable cases, and deposited in the office of the Secretary of the Commonwealth, to be by him there carefully preserved.

Section 8. It shall be lawful for the Governor of this Commonwealth, when he shall deem it expedient, to have tested the conformity of said positive standards of measure and weight to the foregoing provisions of this act, or to the natural invariable standards hereinafter provided; and if Congress shall, at any time hereafter, establish standards of weight and measure, the standards aforesaid shall be made to conform thereto.

Section 9. It shall be the duty of the Governor, to provide, within three years after the passage of this act, for each of the counties of this Commonwealth, at the charge of the counties respectively, positive standards of measures of length, of capacity, and of weight, of the several denominations in common use, or such of them as may be necessary for the accurate and convenient adjustment of weights and measures; said standards to be of approved construction, carefully compared with the State standards aforesaid, and made of the same material: and, having caused the same to be duly stamped, to have them delivered to the Commissioners of the counties respectively, to be used as standards for the adjusting of weights and measures, and for no other purpose.

Section 10. It shall be the duty of the Commissioners of the respective counties, at least once in every ten years, and oftener if they have reason to believe it necessary, to cause the standards of the respective county to be examined and tried, and, if necessary, to be corrected or renewed, according to the standards of the Commonwealth, heretofore referred to.

Section 11. It shall be the duty of the Governor, within ten years after the passage of this act, to cause the positive standards, herein described, to be referred to natural invariable standards, and to deposit, in the office of the Secretary of the Commonwealth, the authentic certificates of such reference, with the apparatus by which it was made: the length of the standard yard to be compared with that of the pendulum vibrating seconds, at a certain and defined spot in the Independence square, in the city of Philadelphia, or in some unalienable public property, at an ascertained and convenient temperature and pressure—all the circumstances of the comparison to be stated; the standard of weight to be compared with that of one hundred standard cubic inches of water, at its maximum density, and at a convenient atmospheric pressure.

Section 12. The denomination of linear measure of this Commonwealth, whereof the yard as heretofore provided is the standard unit, with the relations thereof, shall be as follows:

Twelve inches make one foot;
Three feet make one yard;
Five and a half yards make one rod, pole or perch;
Forty rods make one furlong;
Eight furlongs make one mile.

Section 13. The denominations of superficial measure of this Commonwealth, whereof the square of the linear yard, as heretofore provided, is the standard unit, with the relations to said standard and to each other, shall be—

Thirty and one-fourth square yards make one pole or perch;
Forty square poles make one rood;
Four square roods make one acre;
Six hundred and forty acres make one square mile.

Section 14. The denominations of liquid measure of this Commonwealth, whereof the gallon, as heretofore provided, is the standard unit, with the relations to said unit and to each other, shall be—

Four gills make one pint;
Two pints make one quart;
Four quarts make one gallon;
Thirty-one and a half gallons make one barrel;
Two barrels make one hogshead;
Two hogsheads make one pipe;
Two pipes make one tun.

Section 15. The denominations of dry measure of this Commonwealth, whereof the bushel, as heretofore provided, is the standard unit, with the relations to said standard and to each other, shall be—

Four pecks make one bushel;

And the minor divisions of the peck shall be its aliquot parts: *Provided*, That the form of the dry measure shall be conical; that the diameter of the circle of the top of the measure shall be not less than one-twentieth greater than the diameter of the bottom of the measure, and the height not more than nine-twelfths the diameter of the bottom.

Section 16. The denominations of weight of this Commonwealth, whereof the Troy pound, as heretofore provided, is the standard unit, with the relations thereof to the said standard and to each other, shall be—

Twenty-four grains make one pennyweight;
Twenty pennyweights make one ounce;
Twelve ounces make one pound.

Section 17. The denominations of weight of this Commonwealth, whereof the pound avoirdupois, as heretofore provided,

is the standard unit, with the relations to said pound and to each other, shall be—

Sixteen drams make one ounce;
Sixteen ounces make one pound;
Twenty-five pounds make one quarter;
Four quarters make one hundred;
Twenty hundred make one ton.

WILLIAM PATTERSON,
Speaker of the House of Representatives.

JACOB KERN,
Speaker of the Senate.

APPROVED—The fifteenth day of April, Anno Domini, eighteen hundred and thirty-four.

GEO: WOLF.

LONG MEASURE.

Long measure is used for measuring lengths or distances—the denominations, degree, league, mile, furlong, pole, fathom, yard, foot, hand, and inch.

4	Inches	equal	1	hand,* marked	h.
12	Inches	"	1	foot	" ft.
3	Feet	"	1	yard,	" yd.
6	Feet	"	1	fathom*	" fm.
5.5	Yards	"	1	pole,	" p.
40	Poles or 220 yards,	"	1	furlong,	" fur.
8	Furlongs or 1760 yds.	"	1	mile,	" m.
3	Miles	"	1	league,*	" l.
60 69.5	Geographic, or Statute miles,	"	1	degree,	" deg.
360	Degrees	"		the circumference of the earth.	

Distances are also measured by a four pole chain, viz:

7.92	Inches	equal	1	link, marked	l.
100	Links	"	1	chain, "	ch.
80	Chains	"	1	mile, "	m.

---

* *Hand*, is a term used in measuring the height of horses; *fathom*, the depth of water; and a *league*, distance at sea.

The American mile - - equals 5280 feet.
French, " - - " 5328 "
Italian, " - - " 5566 "
Scotch, " - - " 7920 "
German, " - - " 26400 "
Dutch, Spanish or Polish, " 21120 "
Indian mile, about three American.

1. Required the earth's circumference in inches.

Degrees.
360
69.5
1800
3240
2160
25020.0 Miles.
8
200160 Furlongs.
220
40032
40032
44035200 Yards.
3
132105600 Feet.
12
1585267200 Inches.

2. In 56231427800 inches, how many miles?

12)56231427800
3)4685952316 + 8
220 { 11)1561984105 + 1
2,0)14199855,5
8)7099927 + 15, and 15 × 11 = 165
887490 + 7

Whence the answer is, 887490 miles, 7 furlongs, 165 yards, 1 foot, 8 inches.

3. Reduce 546 miles to inches. Ans. 34594560 inches.
4. In 3 miles, how many chains? Ans. 240 chains.
5. In 165 yards, how many poles? Ans. 30 poles.
6. Reduce 149 miles to furlongs. Ans. 1192 furl's.
7. Bring 571 furlongs to yards. Ans. 125620 yards.
8. In 64 poles, how many yards? Ans. 352 yards.
9. Reduce 17 miles 6 furl'gs to furlongs. Ans. 142 furl's.

LAND MEASURE, OR SQUARE MEASURE.

Land (or square) Measure is used for finding the contents of land and other surfaces, and has respect to length and breadth. The denominations are, mile, acre, rood, square perch, square yard, square foot, and square inch.

144	Square inches - -	equal 1	square foot, ft.
9	Square feet - -	" 1	square yard, yd.
30.25	Square yards - -	" 1	square perch, P.
40	Square perches - -	" 1	rood, R.
4	Roods, or 160 square perches,	" 1	acre, A.
640	Acres - - - -	" 1	mile, M.
10	Square chains - -	" 1	acre.
6400	Square chains - -	" 1	mile.

1. In 47 acres, 2 roods, 17 perches, how many perches?

A.	R.	P.
47	2	17
4		
190		
40		
7617		

2, One square mile is called a section of land—How many perches are there in 4 sections?

4	Sections.
640	
2560	Acres.
4	
10240	Roods.
40	
409600	Perches.

3. In 7462 perches, how many acres?
Ans. 46 A., 2 R., 22 P.

4. A tract of land contains 11740 perches—required the content in acres. Ans. 73 A., 1 R., 20 P.

5. In 51 A. 2 R. 39 P., how many perches? Ans. 8279.

LIQUID MEASURE.

Liquid measure is used for beer, cider, wine, &c. [See section fourteenth of the preceding act of Assembly.]

1. Reduce 7 hhds. 15 galls. 3 qts. of wine to gills.

Hhds.	Galls.	Qts.
7	15	3
63		
456		
4		
1827		
2		
3654		
4		
14616	Answer.	

2. In 20048 gills, how many hogsheads?

Gills.

4)20048

2)5012

4)2506

63 { 7)626 + 2

9)89 + 3

9 + 8 and 7 × 8 + 3 = 59.

Whence the answer is 9 hhds. 59 galls. 2 quarts.

3. In 16 barrels of beer, how many pints? Ans. 4032.

4. Reduce 18 hhds. 1 barrel of wine, to gills. Ans. 37296.

5. How many gallons in 28 barrels of beer? Ans. 882.
6. Bring 12 hhds. 1 barrel, to pints. Ans. 6300.
7. Reduce 19 hhds. 1 barrel, 1 gal. 1 pt. to gills. Ans. 39348.

DRY MEASURE.

This measure is used for dry goods. The Winchester bushel is of a cylindrical form, 18.5 inches in diameter and 8 inches deep, and contains 2150.4252 cubical inches; that described in section 15th of the preceding act of Assembly, is the frustrum of a cone, the top diameter of which is 15.902607 inches, the bottom diameter 15.14534 inches, and height 11.359005 inches. Grain, salt, &c., are measured by level or struck measure; charcoal, lime, roots, fruit, oysters, &c., by heaped measure, which is about three-sixteenths more than level measure. The bushel contains 2553.62 cubical inches. The dimensions of a half bushel measure, of a similar shape to the Pennsylvania bushel, is, top diameter, 12.6219 inches, the bottom, 12.02086 inches, and height, 9.01564 inches.

2 Pints	equal	1 quart,	qt.
8 Quarts	"	1 peck,	p.
4 Pecks	"	1 bushel,	bu.

1. Reduce 91 bu. 2 ps. 7 qts., to pints.

Bu.	P.	Qts.
91	2	7
4		
366		
8		
2935		
2		
5870	Answer.	

2. Reduce 12 bushels, 2 pecks, to pecks. Ans. 50.
3. Reduce 16 bushels, 1 peck, 2 quarts, to quarts. Ans. 522.
4. Bring 15 bushels, 2 pecks, 3 quarts, 1 pint, to pints. Ans. 969.
5. In 421 pecks, how many bushels? Ans. 105 bu. 1 p.

6. In 3105 quarts, how many bushels? Ans. 97 bu. 1 qt.
7. In 541 pints, how many bushels?
Ans. 8 bu. 1 p. 6 qts. 1 pt.

TROY WEIGHT.

This weight is used for weighing jewels, gold, silver, and liquors: the denominations are, pounds, ounces, pennyweights and grains. [See sixteenth section of the preceding act of Assembly.

1. In 123 lbs. 6 oz. 12 dwts. 16 grains of gold, how many grains?

lbs.	oz.	dwts.	grs.
123	6	12	16
12			
1482			
20			
29652			
24			
118624			
59304			
711664	Answer.		

2. Reduce 12 lbs. 4 oz., to ounces. Ans. 148.
3. Reduce 5 lbs. 2 oz. 16 dwts., to pennyweights. Ans. 1256.
4. Reduce 17 lbs. 6 oz. 4 dwts. 12 grs., to grains. Ans. 100908.
5. Bring 9764 grains to pounds.
Ans. 1 lb. 8 oz. 6 dwts. 20 grs.
6. Bring 12547 grains to pounds.
Ans. 2 lbs. 2 oz. 2 dwts. 19 grs.

AVOIRDUPOIS WEIGHT.

By this weight are weighed things of a coarse drossy nature, and all metals, except silver and gold. The denominations are, ton, hundred weight, quarter, pound, ounce, and dram.

16 Drams (dr.)	equal	1 ounce, - - - oz.
16 Ounces	"	1 pound, - - - lb.
25 Pounds	"	1 quarter of a hundred, qr.
4 Quarters	"	1 hundred, - - C.
20 Hundred	"	1 ton, - - - T.

Examples.

1. In 16 T. 4 C. 3 qrs. 19 lbs. 11 oz. 15 drs., how many drams?

T.	C.	qr.	lbs.	oz.	drs.
16	4	3	19	11	15
20					
324					
4					
1299					
25					
6514					
2598					
32494					
16					
194975					
32494					
519915					
16					
3119505					
519915					
8318655	Answer.				

2. Reduce 12 T. 3 C., to hundred weights. Ans. 243.
3. Reduce 5 T. 2 C. 2 qrs., to quarters. Ans. 410.
4. Reduce 10 C. 3 qrs. 12 lbs., to pounds. Ans. 1087.
5. In 5 tons, how many pounds, ounces, and drams?
Ans. 10000 lbs.; 160000 oz.; 2560000 drs.
6. Reduce 51004 drams to ounces. Ans. 3187 oz. 12 drs.
7. Bring 16430 ounces to pounds. Ans. 1026 lbs. 14 oz.
8. Reduce 12915 ounces to hundred weights.
Ans. 8 C. 7 lbs. 3 oz.
9. Bring 2240 pounds to tons. Ans. 1 T. 2 C. 1 qr. 15 lbs.
10. In 1232000 drams, how many tons?
Ans. 2 T. 8 C. 12 lbs. 8 oz.

Note.—In some parts of Pennsylvania, twenty-eight pounds yet pass for a quarter, as is also the case in some other States: in such locations the following table should be used—

16 Drams	-	equal	1 ounce.
16 Ounces	-	"	1 pound.
28 Pounds	-	"	1 quarter of a hundred.
4 Quarters	-	"	1 hundred weight.
20 Hundred weight.		"	1 ton.

1. In 16 T. 5 cwt. 3 qrs. 7 lbs. 11 oz. 15 drs., how many drams? Ans. 9341887.
2. In 12 T. 3 cwt., how many pounds? Ans. 27216.
3. In 1 cwt. 2 qrs. 12 lbs., how many pounds? Ans. 180.
4. Bring 3 qrs. 7 lbs. 15 oz. 1 dr. to drams. Ans. 23537.
5. Reduce 5 tons to drams. Ans. 2867200.
6. Reduce 52036 drams to hundreds.
   Ans. 1 cwt. 3 qrs. 7 lbs. 4 oz. 4 drs.
7. Reduce 16032 ounces to hundreds.
   Ans. 8 cwt. 3 qrs. 22 lbs.
8. Bring 12345678 drams to tons.
   Ans. 21 T. 10 cwt. 2 qrs. 9 lb. 4 oz. 14 drs.
9. In 784765 ounces, how many tons?
   Ans. 21 T. 17 cwt. 3 qrs. 19 lbs. 13 oz.

THINGS BOUGHT AND SOLD BY THE TALE:

12 Particulars or things	equal	1 dozen,	- doz.
12 Dozen - -	"	1 common gross,	gro.
12 Common gross -	"	1 great gross, -	g. gro.
20 Particulars - -	"	1 score, - - -	sco.

Examples.

1. In 95 gross, how many dozen? Ans. 1140.
2. In 16 great gross, how many dozen? Ans. 2304.
3. In 11 great gross of eggs, how many score?
   Ans. 79 sc. 4 eggs.

APOTHECARIES' WEIGHT.

Apothecaries mix their medicines by this weight, but buy and sell by avoirdupois weight. The denominations are, pound, ounce, dram, scruple, and grain.

20	Grains (gr.)	equal	1	scruple, ℈.
3	Scruples	"	1	dram, ʒ.
8	Drams	"	1	ounce, ℥.
12	Ounces	"	1	pound, lb.

Examples.

1. In 12 pounds, 1 ounce, 2 drams, 1 scruple, 16 grains, how many grains?

lbs.	℥.	ʒ.	℈.	gr.
12	1	2	1	16
12				
145				
8				
1162				
3				
3487				
20				
69756	Answer.			

2. In 3 drams, 1 scruple, 2 grains, how many grains? Ans. 202.

3. In 1 pound, 1 ounce, 1 dram, 1 scruple, 1 grain, how many grains? Ans. 6321.

4. Reduce 27152 grains to pounds.
Ans. 4 lbs. 8 ℥. 4 ʒ. 1 ℈. 12 grs.

5. Bring 11520 grains to pounds. Ans. 2 lbs.

6. Reduce 714 scruples to pounds. Ans. 2 lb. 5 ℥. 6 ʒ.

7. In 20000 grains, how many pounds.
Ans. 3 lbs. 5 ℥. 5 ʒ. 1 ℈.

CLOTH MEASURE.

By this measure, cloths, tapes, or whatever is bought or sold by the yard, are measured. The denominations are, yard, quarter, nail and inch.

2.25	Inches (in.)	equal	1	nail, - - na.
4	Nails	"	1	quarter of a yard, qr.
4	Quarters	"	1	yard, - - yd.

Examples.

1. In 5 yards, 3 quarters, 1 nail, 1.75 inches, how many inches?

Yds.	qr.	na.	in.
5	3	1	1.75
4			
23			
4			
93			
2.25			
640			
186			
186			

211.00 = 211 inches. Ans.

2. Reduce 215 quarters to yards. Ans. 53 yds. 3 qrs.
3. Reduce 191 nails to quarters. Ans. 47 qrs. 3 nas.
4. In 16 yards, 2 qrs. 1 nail, how many nails? Ans. 265.
5. In 30 yards, how many quarters and nails? Ans. 120 qrs.; 480 nails.
6. Bring 30 nails to quarters. Ans. 7 qrs. 2 nails.
7. Reduce 154 nails to yards. Ans. 9 yds. 2 qrs. 2 nas.
8. Bring 900 inches to yards. Ans. 25 yards.
9. Bring 108 inches to yards. Ans. 3 yards.

CUBIC, OR SOLID MEASURE.

The solid content of that which comprises length, breadth and thickness, is ascertained by this measure. The denominations are, ton, perch, cord, bushel, yard, foot, and inch.

1728	Cubic inches (c. in.)	equal 1 cubic foot,	c. ft.
46656	Cubic in. or 27 c. ft.	" 1 cubic yard,	c. yd.
2150.42	C. in. or 1.24446 c. ft.	" 1 bushel of st. meas.	bu.
2553.624	Cubic in. or 1.4778 c. ft.	" 1 bu. of heap'd measure.	
128	Cubic feet - - -	" 1 cord, - -	cd.
24.75	Cubic feet - - -	" 1 perch, - -	ph.
40	Ft. of sq. (saw'd) timber, or	1 ton, - -	T.
50	Feet of round timber, =		

Examples.

1. In 500 cubic feet, how many inches, yards, bushels of struck measure, also of heaped measure, cords, perches, tons of round, also of square timber?

C. ft. 500 × 1728 = 864000 Inches.

C. ft. 1.24446)500.00000(401 Bu. .97154 C. ft. Struck measure,
497 784
2 21600
1 24446
.97154

C. ft. 3)500 = 166 + 2
9)166 + 2 = 18 Yds. 14 ft.
27

C. ft. 1.4778)500.0000(338 Bu. .5036 C. ft. Heap'd meas.
443 34
56 660
44 334
12 3260
11 8224
.5036

C. ft. 128)500(3 Cords.
384
116

C. ft. 24.75)500.00(20 P. ft. 5
495 0
5.00

C. ft. 4,0)50,0 = 12.5 Tons square timber.

C. ft. 5,0)50,0 = 10 Tons of round timber.

2. In 9 cubic feet, 1 cubic inch, how many inches?
Ans. 15553.

3. In 12 cords, 6 feet, how many feet? Ans. 1542.

4. Reduce 96 cubic feet to perches. Ans. 3 phs. 21.75 c. ft.

5. Bring 9 bushels of struck measure to inches.
Ans. 19353.78.

6. Reduce 3 cubic yards to bushels, struck measure.
Ans. 65 bu. 190.7 c. in.

7. In 6 cords, 101 feet, how many feet? Ans. 869.

PAPER.

The sizes of Paper are designated by post, foolscap, medium, super-royal, imperial, elephant, atlas, and antiquarian. The denominations are, bale, bundle, ream, quire and sheet.

24 Sheets (sh.) - -	equal	1 quire,	qr.
20 Quires, or 472 sheets,	"	1 ream,	re.
2 Reams - -	"	1 bundle,	bun.
5 bundles, or 10 reams,	"	1 bale,	ba.

The two outside quires of a ream of paper contain only 20 sheets: these are broken or defective, and are termed *cassie*.

Examples.

1. In one ream of paper, how many sheets?

R.
1
20
—
20
24
—
480

The two outside quires want 8 sheets of being full.

—
472 Answer.

2. In 16492 sheets of paper, how many reams?

Sh. R. qr. sh.
472)16492(34 18 12
1416
—
2332
1888
—
24)444(18—12
24
—
204
192
—
12

Here, after dividing by 472, there are 444 sheets remaining, which must be reduced to quires.

3. Reduce 12 bundles, 1 ream, 15 quires, 11 sheets, to sheets.

Bun.	re.	qr.	sh.
12	1	15	11
2		24	
25		71	
472		30	
50		371	
175			
100			
11800			
371			
12171	Answer.		

4. In 1 bale, 2 bundles, 1 ream, 5 quires, 12 sheets, how many sheets? Ans. 7212.

5. In 146 reams, how many sheets? Ans. 68912.

TIME.

By this table is taught the computation of time. The denominations are, year, month, week, and day.

60 Seconds (sec.) - -	equal	1 minute, -	M.
60 Minutes - - -	"	1 hour, - -	H.
24 Hours - - -	"	1 day, - -	D.
7 Days - - -	"	1 week, - -	W.
4 Weeks - - -	"	1 lunar month,	L. M.
13 Months, 1 day, 6 hours,	"	1 year, - -	yr.
12 Calendar months (c. m.)	"	1 year.	
52 Weeks, 1 day, 6 hours,	"	1 year.	
365 Days, 6 hours, - -	"	1 year.	
100 Years - - -	"	1 century, -	Cent.

Names of the calendar months:

1. January,	having	31 days.	7. July,	having	31 days.
2. February,	"	28 "	8. August,	"	31 "
3. March,	"	31 "	9. September,	"	30 "
4. April,	"	30 "	10. October,	"	31 "
5. May,	"	31 "	11. November,	"	30 "
6. June,	"	30 "	12. December,	"	31 "

The length of a year is computed to be 365 days, 6 hours, nearly; hence a common year consists of 365 days, and every fourth is called a leap year, of 366—the second month, February, having 29 days assigned it. The number of days assigned each month, may perhaps be the better recollected by the following:—

The fourth, eleventh, ninth and sixth,
Have thirty days to each affixed;
And every other thirty-one,
Except the second month alone,
Which has but twenty-eight in fine,
Till leap year gives it twenty-nine.

Or,

Thirty days hath September,
April, June and November;
Each of the rest has thirty-one,
Except February alone,
To which we twenty-eight assign—
But leap year gives it twenty-nine.

When the year will divide by four, and have no remainder, it is leap year; but if any remain it is so many years after leap year.

Examples.

1. Reduce 1837 years to seconds.

Years.	
1837	
365.25	
9185	
3674	
9185	
11022	
5511	
670964.25	Days.
24	
268385700	
134192850	
16103142.00	Hours.
60	
966188520	Minutes.
60	
57971311200	Seconds. Answer.

2. In 27 weeks, how many days? Ans. 189.
3. In 19 lunar months, how many weeks? Ans. 76.
4. In 62 hours, how many minutes? Ans. 3720.
5. Change 163 seconds to minutes. Ans. 2 min. 43 sec.
6. Bring 12 days to seconds. Ans. 1036800.
7. Reduce 91 years to weeks. Ans 4748.25.
8. In 7 years, how many weeks, days, and hours?
Ans. 365.25 weeks; 2556.75 days; 61362 hours.

MOTION, OR CIRCLE MEASURE.

This measure is used by astronomers, navigators, &c. The denominations are, revolution or circle, sign, degree, minute, and second.

60 Seconds (″)	-	equal 1 minute,	- ′.
60 Minutes	- -	" 1 degree,	- °.
30 Degrees	- -	" 1 sign,	- - sig.
12 Signs, or 360 degrees		" 1 revolution or circle.	

The latitude and longitude of any place is reckoned in degrees and minutes: thus, New Italy is situated in lat. 39° 59′ north of the equator, and longitude 75° 51′ west from London, or 43′ west from Philadelphia.

Examples.

1. In 2 signs, 6 degrees, 41 minutes, 40 seconds, how many seconds?

Sig.	°	′	″
2	6	41	40
30			
66			
60			
4001			
60			
240100	Answer.		

2. How many degrees in 41 signs? Ans. 1230.
3. Change 1 revolution to minutes. Ans. 21600.
4. In 160000 seconds, how many signs?
Ans. 1 sig. 14° 26′ 40″.
5. Bring 3 signs to minutes. Ans. 5400.

6. Reduce 14680 seconds to degrees. Ans. 4° 4′ 40″.

7. In 13 degrees, 12 minutes, how many seconds?

Ans. 47520.

Application.

1. How many lockets, each to weigh 12 pennyweights, will 3 pounds, 1 ounce, 4 pennyweights of gold, make?

lb.	oz.	dwt.
3	1	4
12		
37		
20		
12,744		

62 Answer.

2. How many plates, each to weigh 6 ounces, will 36 pounds, 6 ounces of silver, make? Ans. 73.

3. In 17 bags of coffee, each 72 pounds, how many hundred weight? Ans. 12 C. 24 lb.

4. In 25 pounds of drugs, how many parcels, each containing 20 drams? Ans. 120.

5. Required the circumference of the earth in inches.

Ans. 1585267200.

6. Required the number of revolutions a wheel, 9 ft. 2 inches in circumference, will make, in running 75 miles.

Ans. 43200.

7. In 5 bales of cloth, each 16 pieces, and each piece 21 yards, how many nails? Ans. 26880.

8. A tract of land, containing 216716 square perches, is to have one plantation, containing 114 acres, 3 roods, 4 perches, taken from it, and the remainder to be divided into 11 plantations. Query—the number of acres in each?

Ans. 112 A. 2 R. 32 P.

9. How many pint bottles may be filled with a cask of wine containing 45 gallons? Ans. 360.

10. How many bags, each to contain 3 bushels, may be filled from a granary of wheat containing 100 cubical feet?

Ans. 26 bags, 2 bu. .4435 c. ft.

11. How many hours, minutes, and seconds, are there in any leap year? Ans. 8784 H.; 527040 M.; 31622400 S.

12. Reduce 12398400 seconds to weeks.
Ans. 20 W. 3 D. 12 H.

13. How many seconds are there in a complete revolution of any planet? Ans. 1296000 sec.

14. How many steps, of 2 feet 10 inches each, must a person take in walking from New Italy to Harrisburg, the distance being 55 miles? Ans. 102494 steps, and 4 inches over.

15. How many yards from New Italy to Lancaster, the distance being 19 miles? Ans. 33440.

16. How many inches is a horse in height, which measures 18 hands, 1 inch? Ans. 73.

17. In 75 yards, 3 quarters, 1 nail, how many inches?
Ans. 1213.

18. Reduce 124.446 cubical feet to bushels. Ans. 100.

19. How many hours are in there in a week? Ans. 168.

20. Bring 5874 feet to poles. Ans. 356.

ENGLISH MONEY.

The denominations are, pound, shilling, pence and farthing.

4 Farthings	(qr.)	equal 1 penny,	d.
12 Pence	"	1 shilling,	s.
20 Shillings	"	1 pound,	£.

1. In 3£. 13s. 4¾d., how many farthings?

£.	s.	d.
3	13	4¾
20		
73		
12		
880		
4		

3523 Answer.

2. In 12£. 6s. 9d., how many pence? Ans. 2961.

3. Reduce 3560 farthings to pounds. Ans. 3£. 14s. 2d.

4. Bring 17643 farthings to pounds. Ans. 18£ 7s. 6¾d.

To find the Value of French Gold Coins.

RULE.

Reduce the weight of the coin to grains, then divide by 27.5 —the quotient will be the answer in dollars and decimal parts.

Required the value of a French pistole, the weight whereof is 4 pennyweights, 4 grains.

Dwt. gr.
4 4
24
—
8
27.5)100.0(3.6363 + Answer.
825
—
1750
1650
—
1000
825
—
1750
1650
—
1000
825
—
175

To find the Value of either United States, Great Britain or Portugal Gold.

RULE.

Reduce the weight of the coin to grains, then divide by 27 —the quotient will be the answer in dollars and decimal parts.

1. Required the value of an Eagle, the weight whereof is 11 pennyweights, 6 grains.

Dwt. gr.
11 6
24
—
50
22 8
27)270(10 Answer.
27
—
0

2. Required the value of an English Guinea, the weight whereof is 5 pennyweights, 6 grains.

Dwt. grs.
5 6
24
— $
27)126(4.667 nearly.
108
—
180
162
—
180
162
—
180
189

3. Required the value of a Johannes, the weight whereof is 18 pennyweights.

Dwt.
18
24
—
72
36
— $
27)432(16 Answer.
27
—
162
162

4. Required the value of a quarter Eagle, the weight whereof is 2 pennyweights, 19.5 grains. Answer $2.50.

5. Required the value of a Sovereign, or pound sterling, the weight whereof is 5 pennyweights. Ans. $4.444.

FEDERAL MONEY, OR MONEY OF THE UNITED STATES.

The denominations are, eagle, dollar, dime, cent, and mill.

10 Mills (m.)	- equal	1 cent,	- ct.
10 Cents - -	"	1 dime,	- di.
10 Dimes, or 100 cents,	"	1 dollar,	$ or dol.
10 Dollars - -	"	1 eagle,	- E.

In reading federal money, and keeping accounts, eagles and dimes are not named: eagles are read tens, &c., of dollars, and dimes tens of cents. Federal money, by one writing, is expressed in every denomination, thus, 5493 cents; and 5 eagles, 4 dollars, and 93 cents, are expressive of the same value; therefore, properly speaking, there is no reduction of federal money, the decimal form making the dollar. The money unit is properly adapted to practical purposes, and has been sanctioned by a law of the United States.

In this work, dollars will be considered whole numbers, and cents and mills decimal parts of a dollar; thus, 12 dollars, 32 cents, and 7 mills, will be expressed, $12.327—mills belonging to the third number at the right hand of the decimal point.

If the number of cents be less than ten, write the figure expressing the number, and prefix a cipher before it—that is, between the figure and the decimal point; thus, for 8 cents, write .08 dollars. If there be no cents, and the number of mills be less than 10, prefix two ciphers, between the figure expressing the number and the decimal point; thus, for 7 mills, write .007 dollars.

Examples.

1.	12 Dollars, 19 cents, 5 mills,	equal	$12.195
2.	7 Dollars, 16 cents, 4 mills,	"	7.164
3.	6 Dollars, 5 cents, - -	"	6.05
4.	17 Dollars, 6 mills, - -	"	17.006
5.	10 Dollars, 2 mills, - -	"	10.002
6.	26 Dollars, 9 cents, 3 mills,	"	26.093
7.	19 Dollars, 1 cent, 2 mills,	"	19.012
8.	21 Dollars, 9 cents, 4 mills,	"	21.094
9.	37 Dollars, 12 cents, - -	"	37.12
10.	14 Dollars, 2 mills, - -	"	14.002
11.	2 Dollars, 1 mill, - -	"	2.001
12.	9 Dollars, 5 mills - -	"	9.005

13. 7 Eagles, 6 dollars, 1 mill, - equal $76.001
14. 1 Eagle, 5 cents, 2 mills, " 10.052
15. 5 Eagles, 3 mills, - - " 50.003

The money of the United States is more simple and easy to reckon than that of any other country, as it increases in a tenfold proportion from right to left.

COMPOUND ADDITION.

COMPOUND ADDITION is the adding of several numbers or quantities, of divers denominations, into one sum total—as, yards, feet, inches; tons, hundreds, quarters, &c.

RULE.

Place the sum or number so that each denomination stand under that of the same name. Add the first row or denomination together, as in integers; then divide the sum by as many of the same denomination as makes one of the next greater, setting down the remainder, if any, under the row added, and carry the quotient to the next superior denomination—continuing the same to the last, which add as in addition of integers.

Examples.

£	s.	d.	£	s.	d.	£	s.	d.
5	12	6	9	11	2	7	5	3
4	2	3	7	16	3	2	11	5
6	14	1	4	1	1	6	3	7
7	19	4	9	17	6	4	17	6
6	2	3	8	7	2	9	15	4
be	me	g	bs	mb	y	be	mb	m

A. has owing to him, on bond, 25 pounds, 12 shillings and 4 pence; in bills and notes, 76 pounds, 19 shillings and 6 pence: required the amount. Ans. mey £. mm *s.* me *d.*

Note.—The use of pounds, shillings and pence, in the United States, has nearly become obsolete; it is, therefore, presumed that but very few examples of the kind will be requisite in this work.

LONG MEASURE.

Examples.

M.	F.	P.
2	3	31
6	7	26
7	1	18
4	2	37
5	1	12
yh	m	i

Yds.	ft.	in.
6	1	9
7	2	8
6	4	7
5	7	11
2	1	10
by	e	s

Deg.	G.m.	fur.
16	20	7
52	54	6
3	17	1
12	19	5
2	1	4
rh	gb	o

Application.

1. A. set out on a journey: he travelled the first day 25 miles, 3 furlongs, 6 poles; the second day, 31 miles, 6 furlongs, 27 poles, 5 yards; the third, 34 miles, 29 poles, 5 yards—How many miles did he travel in three days?

M.	fur.	P.	yds.
25	3	6	0
31	6	27	5
34	0	29	5
91	2	23	4.5

Here 4.5 yards is equal to 4 yards, 1 foot, 6 inches; consequently the answer is, 91 miles, 2 furlongs 23 poles, 4 yards, 1 foot, 6 inches.

2. If from Philadelphia to the Black Horse, be 42 miles, 5 furlongs, 27 poles; from thence to the Rising Sun, 4 miles, 7 furlongs, 31 poles; from thence to Lancaster, 14 miles 7 furlongs, 31 poles; from thence to Harrisburg, 35 miles, 7 furlongs, 10 poles—How far is it from Philadelphia to Harrisburg? Ans. 98 miles, 4 fur. 19 p.

LAND, OR SQUARE MEASURE.

Examples.

A.	R.	P.
12	1	19
6	2	7
7	3	28
19	2	26
5	3	29
gy	m	ys

A.	R.	P.
5	1	27
3	2	16
1	3	5
9	1	34
12	2	22
by	b	yi

A.	R.	P.
21	1	29
16	2	15
7	1	39
18	3	27
22	2	20
ro	e	me

Application.

1. Admit a man has a field of wheat, containing 12 acres, 37 perches; two fields of corn, each containing 10 acres, 3 roods, 17 perches; one of rye, containing 16 acres, 2 roods, 3 perches; 41 acres, 27 perches, of pasture; orchard and woodland, 25 acres, 1 rood, and 26 perches—What quantity does he hold in all?

A.	R.	P.
12	0	37
10	3	17
10	3	17
16	2	3
41	0	27
25	1	26
mmo	e	o Ans.

2. If one field contain 16 acres, 3 roods, 16 perches; another, 25 acres, 1 rood, 27 perches; a third, 27 acres, 3 roods, 36 perches; and a fourth, 29 acres, 3 roods, 1 perch—How much in all? Ans. mee acres.

LIQUID MEASURE.

Examples.

T.	hhd.	gal.
4	1	27
2	2	47
1	1	11
6	3	54
7	2	29
yy	b	iy

Gal.	qt.	pt.
5	1	1
6	2	1
7	3	1
4	2	1
6	3	1
bm	m	m

Gal.	qt.	pt.	gil.
5	2	1	3
2	3	1	1
9	1	1	2
11	2	1	3
7	3	0	1
bo	y	e	y

Application.

1. Bought 5 casks of wine, guaging as follows, viz: 94 gallons, 2 quarts, 1 pint; 100 gallons, 3 quarts; 79 gallons, 2 quarts, 1 pint; 105 gallons, 1 pint; and 129 gallons, 1 pint—How much do they all contain? Ans. 509 gal. 1 qt.

2. Sold 4 casks of cider, 3 of which contained each 101 gallons, 2 quarts, and the fourth 19 gallons more than either of the other three. Ans. 425 gallons.

DRY MEASURE.

Examples.

Bu.	P.	qt.
31	1	2
18	0	1
35	2	7
41	3	6
12	1	5
13	3	1
16	1	4
mhs	y	y

Bu.	P.	qt.
17	1	6
12	0	5
27	3	4
16	1	7
5	2	5
4	1	1
19	3	6
meb	b	y

Bu.	P.	qt.
12	1	7
41	2	1
19	1	5
12	2	7
47	3	4
11	1	1
17	2	6
mhy	b	o

Application.

1. Admit a man has 5 granaries, 3 of which contain 101 bushels, 3 pecks, 4 quarts, each, and the other two, 107 bushels, 1 peck, 3 quarts—How much do they all contain?

B.	P.	qts.
101	3	4
101	3	4
101	3	4
107	1	3
imy	b	o Ans.

2. A farmer sold 3 loads of wheat, the first containing 41 bushels; the second, 40 bushels, 3 pecks, 2 quarts; and the third, 38 bushels, 2 pecks, 6 quarts—required the whole amount. Ans. 120 bu. 2 ps.

3. Add 29 bushels, 1 peck, 2 quarts; 47 bushels, 2 pecks; 16 bushels, 1 peck, 6 quarts; 38 bushels, 2 pecks; 118 bushels, 1 peck, and 100 bushels, together, and tell the amount. Ans. 350 bushels.

TROY WEIGHT.

Examples.

lb.	oz.	dwt.	gr.
27	9	16	21
19	6	13	16
16	11	11	13
13	5	9	5
47	4	2	11
51	10	17	19
29	5	14	21
veh	h	h	me

lb.	oz.	dwt.	gr.
4	1	9	16
3	5	12	21
5	7	5	4
2	11	14	16
17	10	12	9
12	9	3	17
14	10	12	14
hm	r	mm	m

lb.	oz.	dwt.	gr.
41	1	13	14
43	2	11	23
15	10	2	16
21	9	10	20
12	7	15	14
42	4	5	1
26	1	12	19
yeb	m	my	mm

Application.

1. Bought 3 pair of buckles, weighing 6 ounces, 12 pennyweights; 4 dishes, weighing 10 ounces, 1 pennyweight, 16 grains, each; 2 dozen spoons, weighing 1 pound, 10 ounces, 18 pennyweights, 12 grains; two cups, weighing 11 ounces, 16 pennyweights, 19 grains, each, with sundry other small articles, weighing 3 pounds, 6 ounces, 11 pennyweights, 14 grains—I desire to know the weight of the whole.

lb.	oz.	dwt.	gr.	
	6	12	0	Buckles.
	10	1	16	Dishes.
	10	1	16	
	10	1	16	
	10	1	16	
1	10	18	12	Spoons.
	11	16	19	Cups.
	11	16	19	
3	6	11	14	Small articles.
mm	i	y	r	Answer.

2. What is the sum of 18 pounds, 3 ounces, 8 pennyweights; 24 pounds, 3 ounces, 10 pennyweights, 21 grains; 28 pounds, 11 ounces, 21 grains; and 17 pounds, 1 ounce, 16 pennyweights, 14 grains? Ans. 88 lbs. 7 oz. 16 dwts. 8 grs.

AVOIRDUPOIS WEIGHT.

Examples.

T.	C.	qr.	lb.	T.	C.	qr.	lb.	oz.	C.	qr.	lb.	oz.	dr.
19	3	1	16	4	1	2	24	15	2	3	12	14	15
12	16	2	20	1	12	1	16	12	1	2	4	3	12
27	5	1	24	12	4	2	14	11	12	1	2	11	11
12	1	1	1	11	12	1	1	4	10	2	7	2	6
5	4	3	4	2	7	3	16	12	11	1	5	7	12
11	5	2	16	19	1	1	3	13	4	2	12	15	13
ro	mo	m	h	gm	e	m	b	b	ib	e	ye	r	g

Application.

1. Suppose a merchant bought 3 hogshead of sugar, weighing 29 hundred, 1 quarter, 20 pounds; one hogshead of rice, weighing 4 hundred, 3 quarters, 16 pounds; 3 hogshead of

tobacco, weighing 6 hundred, 3 quarters, 24 pounds, each—What weight has he to pay carriage for?

C.	qr.	lb.	
29	1	20	Sugar.
4	3	16	Rice.
6	3	24	Tobacco.
6	3	24	
6	3	24	
gg	m	r	

2. What is the weight of the above, computing 28 pounds to a quarter, of the odd pounds? Ans. 55 cwt. 24 lbs.

3. Suppose a merchant bought 6 hogsheads of sugar, weighing as follows, viz: No. 1, 7 hundred, 3 quarters, 16 pounds; No. 2, 12 hundred, 2 quarters, 5 pounds; No. 3, 7 hundred, 2 quarters, 24 pounds; No. 4, 8 hundred, 1 quarter, 17 pounds; Nos. 5 and 6, each 7 hundred, 2 quarters, 21 pounds—How much is the amount? Ans. 52 C. 4 lb.

4. What is the weight of the above, computing 28 pounds to a quarter, of the odd pounds? Ans. 51 cwt. 3 qrs. 20 lbs.

5. In 5 boxes of raisins, weighing as follows, viz: No. 1, 1 quarter, 21 pounds; No. 2, 2 quarters, 5 pounds; No. 3, 2 quarters, 12 pounds; No. 4, 3 quarters, 1 pound; and No. 5, weighing 16 pounds more than No. 1—What is the whole weight? Ans. 3 cwt. 1 lb.

6. What is the weight of the above, computing 28 pounds to a quarter, on the pounds? Ans. 2 C. 3 qrs. 20 lbs.

APOTHECARIES' WEIGHT.

Examples.

lb.	℥	ʒ	℈	gr.	lb.	℥	ʒ	℈	gr.	lb.	℥	ʒ	℈	gr.
1	11	7	2	19	28	11	7	2	17	4	1	7	1	16
12	3	3	1	9	19	8	4	1	13	5	7	1	2	9
2	2	5	0	6	27	7	6	2	17	2	11	0	0	12
19	2	2	1	14	14	10	6	1	13	1	10	6	1	3
21	8	1	1	7	1	5	1	2	11	5	4	1	2	17
6	4	3	1	9	12	1	5	1	1	2	1	5	2	10
hb	s	e	e	i	ss	me	m	e	my	yy	e	o	y	o

Application.

1. If a druggist mix several simples together—1st, 3 ounces, 1 dram, 2 scruples; 2d, 1 dram, 1 scruple, 14 grains; 3d, 4 ounces, 7 drams, 2 scruples, 16 grains; 4th, 3 ounces, 4 pennyweights, 2 scruples, 10 grains—How much do they all weigh?

lb.	℥	ʒ	℈	gr.
	3	1	2	0
		1	1	14
	4	7	2	16
	3	4	2	10
m	e	e	e	e

CLOTH MEASURE.

Examples.

Yds.	qr.	na.
14	1	2
13	2	1
51	1	3
42	2	1
16	3	2
19	1	1
25	2	3
16	1	1
mee	e	y

Yds.	qr.	na.
547	2	3
164	2	1
14	1	3
142	3	2
140	1	1
11	2	3
25	3	2
4	2	1
megy	e	e

Yds.	qr.	na.
1	1	1
2	3	1
5	1	3
1	2	3
5	2	1
2	1	1
4	3	3
6	2	2
be	y	b

1. Sold to A. 21 yards, 3 quarters, 1 nail, of cloth; to B. twice as much; to C. 1 yard, 1 quarter, 1 nail, more than was sold to A. Required the quantity sold.

Yds.	qr.	na.	
21	3	1	to A.
21	3	1	to B.
21	3	1	
21	3	1	to C.
1	1	1	
rr	y	m	

2. Bought 6 pieces of cloth—No. 1, contained 41 yards, 1 quarter, 2 nails; No. 2, contained 33 yards, 2 quarters, 1

nail; No. 3, 39 yards, 2 quarters, 3 nails; No. 4, 29 yards, 3 quarters, 3 nails; Nos. 5 and 6, each 36 yards, 1 quarter, 2 nails—What is the quantity? Ans. 217 yds. 1 qr. 1 na.

8. Bought 7 pieces of linen—No. 1, contained 12 yards, 3 quarters, 3 nails; No. 2, 9 yards, 1 quarter, 1 nail; No. 3, 11 yards, 1 quarter, 2 nails; No. 4, contained as much as No. 1 and No. 3, together; No. 5, contained as much as No. 2 and No. 4, together; No. 6, contained as much as No. 1 and No. 2; and No. 7, contained as much as No. 5 and 6. Required the quantity bought. Ans. 169 yds. 2 qrs. 3 nails.

CUBIC, OR SOLID MEASURE.

Examples.

1. Bought 5 loads of bark, measuring as follows, viz: 1st, 116 feet; 2d, 1 cord, 2 feet; 3d, 99 feet; 4th, 1 cord, 12 feet; 5th, 120 feet; also, a stack, containing 45 cords, 26 feet—How much did I buy?

Cord.	c. ft.	
	116	First load.
1	2	Second load.
	99	Third load.
1	12	Fourth load.
	120	Fifth load.
45	26	Stack.
is	mms	Answer.

2. There are 7 pieces of square timber, 5 of them contain 16 feet, each; the other two, 40 feet, each. The number of tons is required. Ans. 3.2 tons.

3. The cellar of a house contains 162 cubical yards; that of the kitchen, 79 cubical yards, 5 feet Required the content of both. Ans. 241 yds. 5 feet.

4. A man has a granary, containing 100 cubical feet; another, containing 109 feet, 1012 inches; a third, containing 88 feet, 441 inches, and a fourth, containing 93 feet, 275 inches. Required the solid content of the whole. Ans. 391 c. ft.

TIME.

Examples.

Yr.	M.	W.	D.
12	1	8	2
7	2	1	5
1	9	2	4
17	6	2	6
9	5	1	5
16	12	2	4
9	3	2	7
oi	b	m	g

Yr.	M.	W.	D.
6	5	3	6
1	13	1	2
3	1	2	5
5	12	3	1
2	1	4	6
1	5	3	2
2	11	2	6
yi	m	y	e

D.	H.	M.	Sec.
17	23	50	27
6	19	12	54
16	12	11	16
14	6	17	24
5	1	3	7
7	9	16	2
15	1	4	16
rb	e	gg	yh

Application.

From the 22d of March to the 4th of July, inclusive, how many days? Ans. 105 days.

MOTION, OR CIRCLE MEASURE.

Examples.

°	′	″
5	27	46
3	39	27
5	16	54
6	9	21
1	17	46
4	39	24
2	55	47
ys	yh	yg

Sig.	°	′	″
1	27	50	12
2	19	35	45
4	17	31	52
5	1	5	2
5	16	19	41
2	17	34	51
4	29	45	24
yo	s	by	io

COMPOUND SUBTRACTION.

COMPOUND SUBTRACTION is the taking of a less sum or quantity from a greater, of divers denominations.

RULE.

Subtract as in integers, only when any of the lower denominations are greater than the upper, then subtract it from as many of that denomination as make one of the next greater, and add the upper number to the remainder; set down the result, and carry one to the next denomination—and so proceed.

Proof—As in integers.

LONG MEASURE.

Examples.

Deg.	G.M.	fur.	P.	Yds.	ft.	in.	Yds.	ft.	in.
19	27	7	12	5	1	9	17	2	9
16	31	6	45	2	2	11	9	2	10
y	gh	e	o	y	m	me	o	y	mm

Application.

1. From 46 miles, 6 furlongs, 19 poles, take 19 miles, 7 furlongs, 20 poles.

M.	fur.	P.
46	6	19
19	7	20
yh	h	bs Answer.

2. Two persons set out from the same place, and travel the same road: at the end of one week, A. has travelled 301 miles, and B. 247 miles, 14 poles. I wish to know how far they are apart. Ans. 53 miles, 7 fur. 26 P.

3. Admit a man set out upon a journey of 375 miles—how far is he from his journey's end, when he has travelled 200 miles, 7 furlongs, 32 poles. Ans. 174 M. 8 P.

4. What is the difference between 7 miles, and 6 miles, 7 furlongs, 39 poles, 5 yards, 1 foot, 5 inches?

M.	fur.	P.	yds.	ft.	in.
7	0	0	0	0	0
6	7	39	5	1	5
				m	Ans.

Here, because $5\frac{1}{2}$ yards equal one pole, I borrow its equivalent, 5 yards, 1 foot, 6 inches; that is, 5 for the yards, 1 for the feet, and 6 for the inches. I then say, 5 from 6 and 1 is left: I carry 1 and say, 1 from 1 and 0 remains; then 5 from 5 and 0 remains; then, as $5\frac{1}{2}$ yards = 1 pole, was borrowed, I carry one to the poles, and say, 40 from 40 and 0 is left, &c.—consequently the difference is only one inch.

5. From 60 miles, 3 furlongs, 16 poles, take 59 miles, 1 furlong, 29 poles, and tell what remains.

Ans. 1 M. 1 fur. 27 p.

6. What is the difference between 100 miles, and 75 miles, 3 furlongs, 20 poles? Ans. 24 M. 4 fur. 20 P.

LAND, OR SQUARE MEASURE.

Examples.

A.	R.	P.
29	3	27
12	1	39
17	1	28

A.	R.	P.
16	1	1
15	2	2

A.	R.	P.
4	3	9
1	3	10

1. A man purchased a tract of land, containing 406 acres, 2 roods, 27 perches, and sold thereof 256 acres, 3 roods, 29 perches—What quantity has he left?

	A.	R.	P.	
Bought	406	2	27	
Sold	256	3	29	
	149	2	38	Ans.

2. A tract of land, containing 900 acres, is to be divided among three persons, A. B. and C.: A. is to have 297 acres, 1 rood, 12 perches; B. 305 acres, 2 roods, 19 perches—What is C.'s share? Ans. 297 A. 9 perches.

3. From a tract of land, containing 100 acres, was sold two lots, each 5 acres, 21 perches—How many acres were left? Ans. 89 A. 2 R. 38 P.

LIQUID MEASURE.

Examples.

T.	hhd.	gal.
5	3	24
4	1	62
1	1	25

T.	hhd.	gal.
6	2	41
3	3	52

Hhd.	gal.	qt.	pt.
20	25	3	0
16	41	3	1

1. Bought 4 casks of cider, containing 126 gallons, of which 96 gallons, 3 quarts, were sold—How much have I left? Ans. 29 gals. 1 qt.

2. A cask of wine, containing 110 gallons, having 51 gallons, 1 qt. drawn from it—How much is left?

Ans. 58 gals. 3 qts.

1. Bought 4 pieces of cloth, containing 31 yards each; of which were sold 3 pieces, and 21 yards, 1 quarter, 2 nails, of the other—How many yards are left?

Ans. 9 yds. 2 qrs. 2 nas.

2. From two pieces of cloth, each 25 yards, 2 quarters, 2 nails, having cut 26 yards, 1 quarter—How many yards are left? Ans. 25 yards.

CUBIC, OR SOLID MEASURE.

Examples.

C. ft.	c. in.
12	1470
3	1720
8	1478

C. yd.	c. ft.
91	16
81	21
9	22

TIME.

Examples.

Yr.	M.	W.	D.
12	1	2	5
3	7	1	6
8	7	0	6

D.	H.	M.	sec.
14	19	43	51
10	20	1	59

1. Jacob, by contract, was to serve Laban 14 years, for his two daughters; and, when he had accomplished 11 years, 11 months, 11 weeks, 11 days—the remaining time is required.

Yr.	M.	W.	D.
14	0	0	0
11	11	11	11
1	11	3	3 Ans.

Here I begin at the days, and, as I cannot take 11 from 7, I borrow 2 weeks, and say, 11 from 14 and 3 are left. I then carry 2 to 11, which make 13; and, as I cannot take 13 from 4, I must borrow as many as will make 13 or more—and find that less than 4 months will not answer. I then say, 13 from 16 and 3 are left. I carry 4 to 11, are 15, borrow 2 years and say, 15 from 26 and 11 are left; carry 2 to 11, are 13, and 13 from 14 and 1 is left.

Note 1.—The interval of time, according to the calendar, between two given dates, may be obtained thus: place the

less under the larger; if the lower number of days be greater than the upper, take the lower number of days from as many days as are in the month of the lower number, and add the upper number of days to this remainder: then subtract and carry as in other cases.

Note 2.—Old Style was changed to New in 1752, except in Russia, where the old style is still in use. When one of the dates is in old style, and the other in the new, eleven days must be taken from the difference for any date before 1800; or 12 days for any time between 1800 and 1900.

2. The compiler of this book was born on the twenty-ninth day of September, 1797—How old was he on the 15th day of July, 1835?

Y.	M.	D.	
1835	7	15	
1797	9	29	
37	9	16	Answer.

As I cannot take 29 from 15, I examine the month in the lower number, and find it contains 30 days. I therefore take 29 from 30, and 1 is left; which I add to 15, the upper number of days.

3. Thomas was born on the 17th of November, 1822; Davis, the 13th of May, 1831—What is the difference of their ages, and what the age of each on the 15th of July, 1835?

Ans. Difference 8 yrs. 5 mos. 26 ds.;
Thomas' age, 12 yrs. 7 mos. 28 ds.;
Davis' " 4 yrs. 2 mos. 2 ds.

4. The first permanent settlement in the United States, was made (in Virginia) on the 10th of June, 1610, (old style) —How many years since, reckoning up to the 15th of July, 1835? Ans. 225 years, 23 days.

5. America was discovered by Christopher Columbus, on the 12th of October, 1492, (old style,) and the independence of the United States declared on the 4th of July, 1776. Required the space of time between those two events.

Ans. 283 ys. 8 mos. 12 ds.

6. A bond was given on the 12th of June, 1831, and paid off the 4th of April, 1835—For what time must the interest be reckoned thereon? Ans. 3 yrs. 9 mos. 22 ds.

MOTION, OR CIRCLE MEASURE.

Examples.

°	′	″	°	′	″	Sig.	°	′	″
25	12	24	16	9	14	1	12	21	16
12	24	36	10	21	35		25	29	38
12	48	48							

When a planet has moved through 11 signs, 11 degrees, 11 minutes, 11 seconds, of its orbit, how much is it short of a complete revolution? Ans. 18° 48′ 49″.

COMPOUND MULTIPLICATION.

Compound multiplication is the multiplying any given sum or quantity, of divers denominations, by any proposed number.

Rule.

Multiply the first denomination by the given number or quantity, divide the product by as many of that as make one of the next—setting down the remainder—and add the quotient to the next superior, after it is multiplied; and so proceed.

If the given quantity is above 12, multiply by any two numbers which, multiplied together, will make the same number; but if no two numbers, multiplied together, will make the exact number, then multiply the top line by as many as is wanting, adding it to the last product.

Proof.—Double the multiplicand, and multiply by half the multiplier.

WEIGHTS AND MEASURES.

Examples.

	M.	fur.	P.	A.	R.	P.	Gal.	qt.	pt.
Multiply	5	3	19	1	3	29	17	2	1
by			2			3			4
Product,	me	h	br	g	b	o	oe	y	e

	Hhd.	gal.	qt.	Bu.	P.	qt.	Bu.	P.	qt.
Multiply	12	29	2	10	1	7	19	3	5
by			5			6			7
Product,	hy	ym	y	hy	b	y	mbs	m	b

	lb.	oz.	dwt.	lb.	oz.	dwt.	gr.	lb.	oz.	dwt.
Multiply	5	8	16	0	1	14	20	3	2	19
by			8				9			10
Product,	iy	h	r	m	b	mb	my	by	g	me

	C.	qr.	lb.	T.	C.	qr.	lb.	oz.	dr.
Multiply	11	2	16	5	2	3	11	5	7
by			11						12
Product,	myr	m	m	hm	mi	m	mm	m	i

	℥	ʒ	℈	lb.	℥	ʒ	℈	lb.	℥	ʒ	℈	gr.
Multiply	1	5	2	2	6	1	2	5	9	6	1	18
by			12				12					12
Prod't,	ye	i	e	be	y	i	e	hs	s	o	m	mh

	Yds.	qr.	na.	Yds.	qr.	na.	Yds.	qr.	na.
Multiply	5	1	3	6	3	1	4	3	2
by			7			9			11
Product,	br	e	m	hm	m	m	gb	y	y

1. Multiply 1 ton, 7 cwt. 3 qrs. 12 lbs., by 27.

	T.	cwt.	qr.	lb.	
Thus,	1	7	3	12	
				9	$\times 3 = 27$
	12	10	3	8	
				3	
	37	12	1	24	

2. Multiply 3 yds. 1 qr. 1 na. by 16. Product, - 53 yards.
3. " 5 M. 2 fur. 7 P. by 25. " 131 M. 6 fur. 15 P.
4. " 10 A. 1 R. 17 P. by 42. " 434 A. 3 R. 34 P.

5. Multiply 6 Gal. 2 qts. 1 pt. by 66. Product, 437 gal. 1 qt.
6. " 19 Bu. 2 P. 6 qts. by 84. " 1653 bu. 3 P.
7. " 1 lb. 5 oz. 16 dwt. by 110. " 163 lbs. 2 oz.
8. " 5 Yds. 3 qrs. 2 nas. by 59.

Yds.	qr.	na.	
5	3	2	× 3
		8	× 7 + 3 = 59
47	0	0	
		7	
329	0	0	
17	2	2	
346	2	2	

9. Multiply 2 yds. 3 qrs. 3 nas. by 118.
Product, 346 yds. 2 qrs. 2 nas.
10. " 5 A. 2 R. 9 P. by 126. Product, 700 A. 14 P.

When the given quantity is greater than the product of any two factors in the table—multiply continually by as many tens, less one, as there are figures in the given quantity; then multiply the last product by the figure in the left of said quantity, (if more than one,) into the multiplicand, and that in the tens place into the first product, &c. Place the several products as in addition, and their sum will be the answer.

Examples.

1. Multiply 5 pounds, 1 shilling, 5 pence, by 457.

£.	s.	d.	
5	1	5	× 7
		10	
50	14	2	× 5
		10	
507	1	8	
		4	
2028	6	8	
253	10	10	
35	9	11	
2317	7	5	Product.

2. Multiply 1£. 4s. 3d. by 569. Product, 689£. 18s. 3d.
3. " 2 yds. 1 qr. 1 na. by 4216. ". 9749 yds. 2 qrs.

COMPOUND DIVISION.

COMPOUND DIVISION is the dividing of several numbers, of divers denominations.

RULE.

Divide the first denomination on the left hand; and if any remains, multiply them by as many of the next less as make one of that; which add to the next, and divide as before.

Proof.—By multiplication.

OF SHORT DIVISION.

Short division, compound, is that wherein the divisor does not exceed 12.

Examples.

£ s. d.	£ s. d.	£ s. d.
2)4 2 6	3)12 1 9	4)5 13 8
y m b	i e o	m r g

M. fur. P.	M. fur. P.	M. fur. P.
5)9 4 20	6)13 2 8	7)16 7 9
m o my	y m yr	y b my + g

Gal. qt. pt.	Gal. qt. pt.	Gal. qt. pt.
8)19 3 0	9)12 1 1	10)17 1 1
y m m + h	m m m	m y m + s

Bu. P. qt.	Bu. P. qt.	Bu. P. qt.
11)73 0 7	12)49 2 6	12)59 3 6
h y g	i e i + h	i b o + me

Yds. qr. na.	Yds. qr. na.	Yds. qr. na.
8)19 1 2	10)15 0 1	12)27 2 3
y m y + h	m y e + m	y m e + mm

OF LONG DIVISION.

Long division, compound, is that wherein the divisor exceeds 12.

1. Divide 543 miles, 1 furlong, 8 poles, by 17.

	M.	F.	P.	M.	F.	P.
Thus,	17)543	1	8(	31	7	24
	51					
	33					
	17					
	16					
	8					
	17)129(			7		
	119					
	10					
	40					
	17)408(			24		
	34					
	68					
	68					

2. Divide 50£. 10s. 2d, by 19. Quotient, 2£. 13s. 2d.
3. " 501£. 10s. 6d. by 19. " 26£. 7s. 11d.—
4. " 40 A. 2 R. 30 P. by 21. " 1 A. 3 R. 30 P.
5. " 78 A. 3 R. 20 P. by 21. " 3 A. 3 R.—
6. " 112 A. 1 R. 16 P. by 37. " 3 A. 6 P. nearly.
7. " 92 Gal. 3 qts. 1 pt. by 59. " 1 gal. 2 qts.—
8. " 243 D. 13 H. 42 M. 12 sec. by 147.
Quotient, 1 D. 15 H. 46 M.—

REDUCTION OF DECIMALS.

REDUCTION OF DECIMALS teaches how to reduce any given vulgar fraction, or fractional part of a day, hour, &c., to a decimal, and the contrary.

Note.—A vulgar fraction is a part or parts of an integer, and is noted thus, $\frac{1}{6}$, one-sixth; $\frac{5}{6}$, five-sixths. The upper number

is called the numerator, and shows the part or parts expressed by the fraction; the lower number is called the denominator, and denotes the number of such parts contained in a unit.

CASE I.

To reduce a Vulgar Fraction to a Decimal.

RULE.

Annex as many ciphers as may be necessary to the numerator of the fraction, and divide by the denominator: the quotient will be the decimal required.

Examples.

1. Reduce $\frac{9}{16}$ to a decimal.

16)9.0000(.5625 Answer.
80
100
96
40
31
80
80

2. Reduce $\frac{1}{2}$ to a decimal. Ans. .5
3. Reduce $\frac{1}{4}$ to a decimal. " .25
4. Reduce $\frac{3}{4}$ to a decimal. " .75
5. Reduce $\frac{5}{8}$ to a decimal. " .625
6. Reduce $\frac{1}{16}$ to a decimal. " .0625
7. Reduce $\frac{7}{16}$ to a decimal. " .4375
8. Reduce $\frac{1}{20}$ to a decimal. " .05
9. Reduce $\frac{5}{12}$ to a decimal. " .41666—
10. Reduce $\frac{9}{17}$ to a decimal. " .52941—

CASE II.

To reduce Weights, Measures, &c. to a Decimal.

RULE.

Set down the lowest name, to which annex as many ciphers as are necessary: divide by the next higher denomination: place the parts given of the next superior denomination on the left hand of the decimal thus found; and so proceed, till you bring out the decimal parts of the highest integer required, by still dividing by the next superior denomination.

Examples.

1. Reduce 3 furlongs, 21 poles, 2 yards, 2 feet, 3 inches, to the decimal of a mile.

Inches.
12)3.00

3)2.25

5.5)2.75(.5
2 75

Poles.
4,0)21.5

8)3.5375000

.4421875

2. Reduce 9 inches to the decimal of a foot. Ans. .75.
3. Reduce 1 foot, 6 inches, to the decimal of a yard. Ans. .5.
4. Reduce 4 furlongs, 20 poles, to the decimal of a mile. Ans. .5625.
5. Reduce 7 furlongs, 39 poles, 5 yards, 1 foot, 5 inches, to the decimal of a mile. Ans. .9999842.+
6. Reduce 35 perches to the decimal of an acre. Ans. .21875.
7. Reduce 1 rood, 12 perches, to the decimal of an acre. Ans. .325.
8. Reduce 7 gallons to the decimal of a hogshead. Ans. .111111.+
9. Reduce one cubical foot to the decimal of a bushel, struck measure. Ans. .80356.+
10. Reduce 15 grains, Troy, to the decimal of a pound. Ans. .0026.+
11. Reduce 16 pennyweights, 9 grains, to the decimal of an ounce. Ans. .8375.
12. Reduce 3 quarters, 24 pounds, to the decimal of a hundred weight. Ans. .99.
13. Reduce 6 ounces, 6 drams, 2 scruples, 14 grains, to the decimal of a pound. Ans. .571875.
14. Reduce 1 inch to the decimal of a yard. Ans. .02777.+

15. Reduce 3 quarters, 3 nails, 2 inches, to the decimal of a yard. Ans. .993.+

16. Reduce 26 cubic feet to the decimal of a cubic yard. Ans. .963, nearly.

CASE III.

To find the Value of any given Decimal Fraction.

RULE.

Multiply the given decimal by as many of the next lower denomination as make one of the higher, separating to the right hand as many decimal figures as there are in the given decimal.

Examples.

1. What is the value of .88125 of a pound Troy?

lb.
.88125
12

10.57500 Ounces.
20

11.500 Pennyweights.
24

12.0 Grains.

Ans. 10 ounces, 11 pennyweights, 12 grains.

2. What is the value of .95 of a mile?

M.
.95
8

7.60 Furlongs.
40

2.4 Poles.
5.5

22.0 Yards.

Ans. 7 furlongs, 2 poles, 22 yards.

3. What is the value of .17 of a year?

.17
365.25

85
34
85
102
51

62.0925 Days.
24

3700
1850

2.2200 Hours.
60

13.20 Minutes.
60

12.0 Seconds.

Ans. 62 days, 2 hours, 13 minutes, 12 seconds.

4. What is the value of .561 of a furlong?
Ans. 22 ps. 2 yds. 1 ft. 3.12 inches.
5. What is the value of .47 of a mile?
Ans. 3 fur. 30 p. 2 yds. 7.2 in.
6. What is the value of .521 of a degree?
Ans. 36 m. 16 fur. 30 p. 2 yds. 7.2 in.
7. What is the value of .16 of an acre? Ans. 25.6 ps.
8. What is the value of .29 of a perch?
Ans. 8 sq. yds. 6 sq. ft. 113.72 sq. in.
9. What is the value of .93 of a bushel?
Ans. 3 pecks, 5.76 quarts.
10. What is the value of .6875 of a bushel? Ans. 2 ps. 6 qts.
11. What is the value of .765 of a pound Troy?
Ans. 9 oz. 3 dwts. 14.4 grs.
12. What is the value of .01 of an ounce Troy?
Ans. 4.8 grs.
13. What is the value of .583 of a pound avoirdupois?
Ans. 9 oz. 5.248 dr.

14. What is the value of .79 of a hundred weight?
Ans. 3 qrs. 4 lbs.

15. What is the value of .674 of a ton?
Ans. 13 C. 1 qr. 23 lb.

16. What is the value of .75 of a scruple? Ans. 15 grs.

17. What is the value of .67 of a great gross?
Ans. 96 dozen, 5.76.

18. What is the value of .875 of a yard?
Ans. 3 qrs. 2 nas.

19. What is the value of .125 of a yard? Ans. 2 nas.

20. How many yards, quarters and nails, are equal to 16.9375 yards? Ans. 16 yds. 3 qrs. 3 nas.

21. What is the value of .49 of a day and .24 of an hour?
Ans. 12 hours.

22. What is the value of .26 of an acre and .96 of a rood?
Ans. 2 roods.

23. What is the value of .86 of a pole and .77 of a yard?
Ans. 1 pole.

24. What is the value of .72 of a nail and .72 of an inch?
Ans. 1.04 nails.

25. What is the value of .8 of a quarter and .8 of a nail?
Ans. 1 qr.

26. What is the value of .75 of a yard and .75 of a foot?
Ans. 1 yd.

27. What is the difference between .75 of a yard, and .75 of a foot? Ans. 1 foot, 6 inches.

28. What is the difference between .7325 of a bushel, and .5 of a peck? Ans. 2 pecks, 3.44 quarts.

29. What is the difference between .875 of a pound avoirdupois, and .25 of an ounce? Ans. 13 oz. 12 drs.

30. What is the difference between .25 of a ton, and .25 of a hundred weight? Ans. 4 C. 3 qrs.

31. What is the value of 5.75 yards? Ans. 1 pole, 9 in.

PRACTICAL QUESTIONS.

It is essentially necessary that the learner should have a competent knowledge of decimals: to attain which, the following examples, in Multiplication and Division of Decimals, are requisite. It will be recollected that cents, annexed to dollars, are decimals of a dollar.

1. What will 12 yards, 2 qrs. 1 nail of cloth come to, at 4 dollars, 27 cents, per yard?

[First reduce the quantity to decimals, then multiply by the price.]

Thus, 4)1.00

4)2.25

12.5625
4.27 Price.

879375
251250
502500

53.641875

Ans. 53 dollars, 64 cents.+

2. What will 93 yards of linen come to, at 27 cents per yard? Ans. $25.11 cts.

3. What will 71 yards of broad cloth come to, at 6 dollars, 59 cents, per yard? Ans. $467.89 cts.

4. What will 12 hundred of hay come to, at 12 dollars per ton? Ans. $7.20 cts.

5. What will 74 acres, 1 rood, 16 perches of land, amount to, at 25 dollars per acre? Ans. 1858 dolls. 75 cts.

6. What will 52 pounds of butter come to, at 12½ cents per pound? Ans. $6.50 cts.

7. I demand the price of 4½ bushels of cloverseed, at $3.10 cts. per bushel. Ans. 13 dolls. 95 cts.

8. At 53 cents a bushel, what will 19 bushels of Indian corn come to? Ans. $10.07 cts.

9. Calculate the amount of 8 acres, 2 roods, 17 perches of land, at 25 dollars per acre? Ans. 215.156 dolls.

10. What is the value of 7 gallons of wine, at 140 dollars per hogshead? Ans. 15 dolls. 55 cts. 5 mills.+

11. What will a peck of potatoes come to, at 50 cents per bushel? Ans. 12½ cts.

12. What will one pound of silver come to, at 90 cents per ounce? Ans. $10.80 cts.

13. I demand the value of 13 barrels of corn, at two dollars, 96 cents, per barrel. Ans. 38 dolls. 48 cts.

14. What is the value of 4 C. 3 qrs. 21 lbs. of rice, at 3 cents per pound? Ans. $14.88 cts.

15. If a kiln contains 876 bushels of lime, what will it amount to at 11½ cents per bushel? Ans. $100.74 cts.

16. What will a cheese, weighing 47 pounds, come to at 6½ cents per pound? Ans. 3 dolls. 5 cts. 5 m.

17. What will 5 cords, 64 feet of black oak bark amount to, at $5.40 cts. per cord? Ans. 29 dolls. 70 cts.

18. What will 41½ perches of mason work come to, at 48 cents a perch? Ans. 19 dolls. 92 cts.

19. What will 963 pounds of pork come to, at $4.75 cts. per 100 pounds? Ans. 45 dolls. 74¼ cts.

20. What will 312 days' work come to, at 40 cents per day? Ans. 124 dolls. 80 cts.

21. What will 105 shad come to, at $6.40 cts. per 100? Ans. $6.72 cts.

22. Calculate the price of 765 pine shingles, at $10.50 cts. per thousand. Ans. $8.03¼ cts.

23. What is the value of 1 peck, 2 quarts of cranberries, at 4 dollars per bushel? Ans. 1 dollar, 50 cts.

24. *New Italy, July 17th*, 1835.

Mr. Elisha Buyers,

Bought of Samuel Sellers:

6¼	Yards of blue broadcloth,	at	$5.12½	$
3½	" Cambric, - -	at	.72	
9¼	" Black silk, -	at	.90	
5¾	" Satin, - -	at	1.12½	
7½	" Lace, - -	at	.62½	
5½	" Cassinet, - -	at	1.08½	
				$60.00

25. Required the value of ⅝ of a cord of wood, at $4.50 cts. per cord. Ans. $3.75 cts.

26. At $10.80 cts. per pound, what is silver per ounce? Ans. 90 cts.

27. If 4 C. 3 qrs. 21 lbs. of rice sell for $14.88 cents, what is it per pound? Ans. 3 cts.

28. If 93 yards of linen sell for 25 dollars, 11 cents, what is it per yard? Ans. 27 cts.

29. Sold 7½ yards of broadcloth for $42.60 cents, what was it per yard? Ans. $5.68 cts.

30. What is the value of 1 cwt. of hay, at 14 dollars per ton? Ans. 70 cts.

31. If 19 A. 3 R. 10 P. of land sell for 400 dollars, what is it per acre? Ans. $20.19 cts. nearly.

32. If 21¼ pounds of butter sell for $4.25 cts., what is it per pound? Ans. 20 cts.

33. If a load of potatoes, containing 41 bushels, 3 pecks, sell for $20.87½ cts., how much are they per bushel. Ans. 50 cts.

34. A kiln of lime, containing 744 bushels, sells for 96 dollars, 72 cents, how much is it per bushel. Ans. 13 cts.

35. If 317 bushels, 1 peck of lime, be spread over 5 acres, 2 roods, 25 perches, how much is it per acre? Ans. 56 bus.

36. Sold 71 bushels, 3 pecks, 4 quarts, of buckwheat, for 50 dollars—What was is it per bushel? Ans. 69 cts. 62 m.+

37. Bought 1980 cedar shingles for $23.76 cents, what was the price per thousand? Ans. 12 dollars.

38. What is the value of one pound of coffee, at 12 dollars per cwt.? Ans. 12 cts.

39. Bought a bag of coffee, containing 56 pounds, at 12 cents per pound; another, containing 44 pounds, at 8 cts. per pound: they were mixed, and sold at such a price as to gain $3.76 cts. on the whole—What was the price this mixture sold at per pound?

56 × .12 = 6.72		Dol.	
44 × .08 = 3.52	And	1,00)14.00	
100 Cost	10.24	Ans.	14 Cts. per lb.
Gain,	3.76		
Sold for	14.00		

40. What is the price of 1 sheet of paper, at 2 dolls. 36 cents per ream? Ans. 5 mills, or ½ cent.

THE SINGLE RULE OF THREE.

THE SINGLE RULE OF THREE teaches, by three numbers given, to find a fourth, in such proportion to the third as the second is to the first.

RULE FOR STATING.

Place that number for the third term, which is of the same name with the answer. Then consider, from the nature of

the question, whether the answer is required to be greater or less than this third term: if greater, place the greater of the other given numbers on the left, for the second term; and the less, on the left of this, for the first term. But if the answer is required to be less than the third term, place the less number for the second term, and the greater for the first.

RULE.

If the first and second terms be not of one denomination, reduce both to the lowest in either, and the third to its lowest denomination mentioned. Multiply the second and third terms together, and divide the product by the first: the quotient will be the answer to the question, in the same denomination you left the third term in.

Proof.—Invert the question; that is, place the answer for the first term, the third term for the second, and the second for the third. Multiply these second and third terms together, and divide by the first; and, if right, the quotient will be the same as the first term of the given question.

Note 1.—The pulse of a person in health beats seventy-five times in a minute.

Note 2.—Sound moves at the rate of 1142 feet in a second.

Examples.

1. If a person sleep 2 hours per day, more than necessary, for the term of 10 years, how long does he deprive himself of the enjoyments of life, by unnecessary slumbering?

	D.		yrs.		H.
As	1	:	10	::	2
			365.25		
			3652.5		
			2		
			24)7305.0(		304 D. 9 H. Answer.
			72		
			105		
			96		
			9		

2. Bought 25 A. 1 rood, 10 perches of land, at 37 dollars per acre: I demand the amount. Ans. 936 dolls. 56¼ cts.

3. If 4 pounds of cheese cost 47 cents, what will 9 pounds cost? Ans. $1.05¾ cts.

4. What will 5½ yards of muslin come to, at 12 cents per yard? Ans. 66 cts.

5. What will 96 yards of broadcloth come to, at 4.56¼ cts. per yard? Ans. 438 dolls.

6. Required the value of 96 acres, 1 rood, 12 perches, at 17 dolls. 40 cts. per acre. Ans. 1676.055 dollars.

7. What is the value of 12 bushels, 3 pecks, 7 quarts of wheat, at 99½ cents per bushel.
Ans. 12 dolls. 90 cts. 4 mills, nearly.

8. What quantity of rice will $67.20 cts. buy, at 3 dollars per C.? Ans. 22 C. 1 qr. 15 lbs.

9. Bought 12 yards, 1 qr. 1 na. of cassinet, for 13 dollars, what was it per yard? Ans. $1.05½ cts.+

10. When a bankrupt compounds with his creditors, at 65 cents in the dollar, what does that creditor lose to whom he owes 1200 dollars? Ans. 420 dollars.

11. What sum will pay for 16 pieces of cloth, each 19 yds. 1 qr. at 5 dollars per yard? Ans. 1540 dollars.

12. If 1 C. 1 qr. 16 lbs. of iron, be worth 10 dollars, what is it per ton? Ans. 141 dolls. 84 cts. 4 mills, nearly.

13. What will 16 C. 3 qrs. 4 lbs. of tobacco come to, at 14 cts. per pound? Ans. $235.06 cts.

14. If 4674 shingles cost 37 dollars, 39 cents, 2 mills, what price are they per thousand? Ans. 8 dolls.

15. What will 5943 cedar rails amount to, at 12 dollars per hundred? Ans. $713.16 cts.

16. Required the price of 26 pounds, 10 ounces of loaf sugar, at 14 dolls. 46 cts. per C.?
Ans. 3 dollars, 85 cents, nearly.

17. If 1½ lbs. butter cost 13¼ cents, what is the price of 5¼ pounds? Ans. 46 cts. 3¾ m.

18. What will 19 bags of coffee, each containing 41½ lbs. come to, at 11¼ cents per pound? Ans. 88.70625 dollars.

19. Sold 5¼ yards of cambric, at the rate of two dollars for 3 yards, what is the amount? Ans. $3.50 cts.

20. How many rings, each weighing 4 dwts. 13 grains, may be made of 1 pound, 10 ounces, 14 pennyweights, 4 grains of gold? Ans. 100, nearly.

21 How many parcels, of 5 lb. 7 lb. 9 lb. and 10 lb., can I have out of 9 hogsheads of tobacco, each weighing neat 4 cwt. 1 qr. 9 pounds? Ans. 126.

22. How many steps of 2 ft. 9 in. will a man take in walking 5 miles, 1 furlong, 26 poles, 2 yards, 2 feet, 3 inches? Ans. 9999.

23. If 4 C. 1 qr. of hay cost 3 dollars, what will 1 qr. 13 pounds cost? Ans. 26 cents, 8 mills.+

24. If a footman perform a journey in 4 days, when the days are 12 hours long, how many days will it require of 16 hours long to perform the same journey? Ans. 3 days.

25. If a staff, 6 feet long, cast a shade (on level ground) 9 feet—What is the height of that steeple, whose shade at the same time measures 100 yards? Ans. 200 feet.

26. How long will it take 7 men to complete a piece of work, which 5 men can do in 21 days? Ans. 15 days.

27. How much in length, that is 9 inches broad, will make a square foot? Ans. 16 inches.

28. If a pair of stockings cost 78 cents, how many dozen pair can I buy for 468 dollars? Ans. 50.

29. If my horse stands me in 13½ cents per day keeping, what will be the charge of 9 horses for 10 weeks? Ans. 85 dollars, 05 cts.

30. Borrowed of my friend, $49.50 cts. for 7 months, and he hath occasion, another time, to borrow of me for 11 months—How much must I lend him to requite his former kindness to me? Ans. $31.50 cts.

31. A merchant bought 37 pieces of stuff, which cost him $416.25 cts. at 75 cents per yard: I demand how many yards were in each piece. Ans. 15.

32. If 27 men can build a house in 100 days, how many days will it take 180 men? Ans. 15.

33. If the carriage of 3 cwt. 1 qr. for 20 miles, be one dollar—How far may I have 4 T. 5 cwt. 1 qr. 9 lb. carried, for the same money? Ans. 1340½ yards.

34. What is the half year's rent of 85 acres of land, at $1.25 cts. per acre, per annum? Ans. $53.12½ cts.

35. If a man spend 7 cents per day for spirituous liquors—What will it amount to in 4 years? Ans. $102.27 cts.

36. A. has 6 acres of pasture, in which he has 5 head of cattle; B. has 3 acres adjoining, in which he has 4 head; C. has 7 head, but no pasture: he succeeds in striking a bargain with A. and B. to remove their line fence, and let all of their cattle go together—and agrees to pay them 8 dollars for

his share of the pasture. I desire to know how much of the money falls to each man's share.

6	5
3	4
—	7
9 Whole number of acres.	—
	16 Number of cattle pastured.

	H.		H.		A.		A.	
As	16	:	5	: :	9	:	2.8125	For A's cattle.
As	16	:	4	: :	9	:	2.25	For B's cattle.
As	16	:	7	: :	9	:	3.9375	For C's cattle, for which he pays 8 dollars.

6 A.—2.8125 A. = 3.1875 A. for which A. is to receive pay.
3 A.—2.25 A = .75 A. for which B. is to receive pay.

	A.		A.		dolls.		$ cts. m.	
As	3.9375	:	3.1875	: :	8	:	6.47.6+	A's share. } Ans.
As	3.9375	:	.75	: :	8	:	1.52.4 nearly,	B's share. }

37. A gun being fired on one side of a river, an observer, directly opposite, counts 12 pulsations at his wrist between seeing the flash and hearing the report—What was the breadth of the river? Ans. 2 M. 24 p. 2 yds. 1.2 ft.

38. A gentleman hath an annual income of 1000 dollars; I desire to know how much he may spend daily, that at the end of the year he may lay up $250, and give to the poor monthly 25 dollars. Ans. 1 dol. 23 cts. 3 mills.

39. A draper bought 15 packages of cloth, each package containing 5 pieces, and each piece 31 yards; and paid at the rate of 1000 dollars for every 10 packages. I desire to know what the 15 packages stood him in. Ans. 1500 dolls.

40. What is the cost of 1 yard, 3 quarters, 3 nails of velvet, when a piece containing 15 yards, 1 quarter, 1 nail, cost 17 dollars, 20 cents? Ans. 2 dolls. 17 cts. 6 m.+

41. If it take 290 Italian mulberry trees to plant one acre, how many will it take to plant 8 acres, 2 roods, 17 perches; and what will be the cost, supposing the price to be 70 dolls. for a hundred dozen trees? Ans. 2496 trees; cost, $145.60 cts.

42. What will 13 ounces of silk cost, if 4 pounds cost 22 dollars? Ans. 4.46875 dollars.

43. Bought a pair of silver buckles, weighing 37 pennyweights, 12 grains, at 1 dol. 12½ cts. per ounce—What did they cost? Ans. $2.109375 dolls.

44. If the report of a piece of ordnance be heard one minute and forty seconds after the flash was observed—the distance is required. Ans. 21 M. 1106 yds. 2 ft.

45. If 40 gallons of water, in one hour, fall into a cistern, containing 256 gallons; and, by a pipe in the cistern, 24 gallons run out in an hour—in what time will it be filled.

Ans. 16 hours.

46. A person failing in trade, owes 1976 dollars, and the inventory of his effects amounts to but 1079 dollars—How much will this produce per dollar to his creditors?

Ans. 54 cts. 6 mills.

47. If a man's annual income be $215.50 cts. and he expend 59 cents per day, what does he save at the end of four years? Ans. 1 cent.

48. A. can chop a cord of wood in two hours; B. in three hours, and C. in three hours and twenty minutes. I desire to know how long it will take them all to chop a cord?

Ans. $55\frac{5}{8}$ M.

49. If I buy 10 acres, 1 rood, 29 perches of land for four hundred dollars, and sell it again at 40 dollars per acre—do I gain or lose, and how much? Ans. $17.25 gain.

50. Sold 31 dozen, 4 pounds of candles, at the rate of 46 cents for 5 pounds: I desire to know how much they come to.

Ans. 34 dolls. 59 cts. 2 mills.

51. If $1\frac{1}{2}$ lb. of coffee cost $15\frac{1}{4}$ cents, what will $4\frac{1}{4}$ pounds come to? Ans. 43 cts. 2 m.+

THE DOUBLE RULE OF THREE,

Is so called, because it is composed of five given terms, to find a sixth—three of which are a supposition, and two a demand.

RULE.

Place that term which is of the same kind with the term sought, for the third term. Complete a statement in the Single Rule, as already taught, with this third term and each pair of similar terms: reduce the third term to its lowest denomination mentioned, and the similar terms to the lowest denomination mentioned in either. Multiply the two quantities in the first term together, and also the two quantities in the second term together. It is then reduced to the Single Rule

of Three. Multiply the second and third terms together, and divide by the first—the quotient will be the answer.

Proof—As in the Single Rule of Three.

Examples.

1. If 56 acres of grass be mowed by 8 men in 6 days, how many acres may 24 men mow in 38 days?

Thus, 8 Men 24 Men
6 Days 38 Days

192
72

Acres.
48 : 912 :: 56
56

5472
4560

48 { 6)51072
8)8512

1064 Acres. Answer.

In this question, the term sought is acres; therefore, 56 acres must be the third term; and, as 24 men will mow more grass in 38 days than 8 men in 6 days, the 24 must be placed for the second term, and the 8 for the first.

2. If 24 pounds of bread be sufficient for 4 men, 24 days—How many pounds will suffice 16 men, 12 days?

Ans. 48 lbs.

3. If the carriage of 115 lb., 25 miles, be $1.50 cts.—how far can I have 1200 pounds carried for 25 dollars?

Ans. 39 M. 1637 yds.

4. If 10 men can accomplish a piece of work in 30 days, working 12 hours per day, how long will it take 6 men, working 16 hours per day, to perform the same? Ans. 13¾ days.

5. If 16 dollars pay 8 men for 5 days' work, how much will pay 32 men for 24 days' work? Ans. $307.20 cts.

6. If 100 dollars, in 12 months, gain 5 dollars interest, what principal will gain 12 dollars, 40 cents, in 7 months?

Ans. 425.1428 dolls.

7. If 2 horses eat 8 bushels of oats in 16 days, how many horses will eat 40 bushels in 8 days? Ans. 20 horses.

8. If 8 men in 14 days build 2000 pannels of fence, how many men must there be to build 1500 pannels in 4 days?

Ans. 21.

9. In a family, consisting of 7 persons, there are used 2 cwt. of flour in 3 weeks, how much will suffice a family of 14 persons, 8 days? Ans. 1 cwt. 2 qr. $2\frac{2}{3}$ lbs.

10. When 12 oxen graze down $16\frac{1}{4}$ acres in 20 days, how much of like pasture would suffice 24 such cattle for 100 days? Ans. $162\frac{1}{2}$ acres.

11. If 12 persons receive 4.625 dollars for 1 day's labor, how much should 4 persons have for $10\frac{1}{2}$ days' work?

Ans. 16.1875 dolls.

12. What money, at $3\frac{1}{3}$ per cent. per annum, will clear 77 dollars in 1 year and 3 months? Ans. 1760 dolls.

PRACTICE.

Practice is a short method of finding the value of any quantity of goods, at a given price, per yard, pound, dozen, &c. All questions in this rule are performed by taking aliquot, or even parts, by which means many tedious reductions are avoided—the tables of which are as follows:

TABLES.

oz.	dwt.	gr.	
1	0	0	= $\frac{1}{12}$
1	4	0	$\frac{1}{16}$
1	6	16	$\frac{1}{20}$
1	10	0	$\frac{1}{24}$
2	0	0	$\frac{1}{30}$
2	8	0	$\frac{1}{40}$
3	0	0	$\frac{1}{48}$
4	0	0	$\frac{1}{60}$
6	0	0	$\frac{1}{80}$

of a pound.

cwt.	qr.	
2	0	= $\frac{1}{10}$
2	2	$\frac{1}{15}$
4	0	$\frac{1}{20}$
5	0	$\frac{1}{24}$
10	0	$\frac{1}{40}$

of a ton.

R.	P.	
	16	= $\frac{1}{10}$
	20	$\frac{1}{8}$
	32	$\frac{1}{5}$
1	00	$\frac{1}{4}$
2	00	$\frac{1}{2}$

of an acre.

Peck.	qt.	
	4	= $\frac{1}{4}$
1	0	$\frac{1}{2}$
2	0	$\frac{1}{1}$

of a bu.

qr.	na.	in.	
		3	= $\frac{1}{12}$
		4	$\frac{1}{9}$
	2	0	$\frac{1}{8}$
		6	$\frac{1}{6}$
1	0	0	$\frac{1}{4}$
2	0	0	$\frac{1}{2}$

of a yard.

RULE.

Multiply the price by the integers of the quantity, and take parts of the price for the rest.

Examples.

1. 53 pounds, 10 ounces, 16 pennyweights, 13 grains, at $5.76 cts. per pound.

oz.		D. cts.	
6	$\frac{1}{2}$	5.76	
4	$\frac{1}{3}$	53	
		1728	
dwt.		2880	
		288	Value of 6 ounces.
10	$\frac{1}{8}$	192	" 4 ounces.
5	$\frac{1}{2}$	24	" 10 pennyweights.
1	$\frac{1}{5}$	12	" 5 do.
gr.		24	" 1 do.
12	$\frac{1}{2}$	12	" 12 grains.
1	$\frac{1}{12}$	1	" 1 do.
		310.477	Answer.

In this question I say, 6 ounces are $\frac{1}{2}$ of a pound, and 4 ounces are $\frac{1}{3}$ of a pound; for both of which, parts are to be taken of $5.76 cents, because they are both parts of a pound, and $5.76 cts. is the price of a pound. Then I say, 10 pennyweights are $\frac{1}{8}$ of 4 ounces: this part must be taken into 192, the value of 4 ounces. I then say, 5 pennyweights are $\frac{1}{2}$ of 10 pennyweights: this part must be taken into 24, the value of 10 pennyweights. I then say, 1 pennyweight is $\frac{1}{5}$ of 5 pennyweights: this part must be taken into 12, the value of 5 pennyweights. I then say, 12 grains are $\frac{1}{2}$ a pennyweight: this must be taken into 24, the value of 1 pennyweight. Then I say, 1 grain is $\frac{1}{12}$ of 12 grains: I take this into 12 grains. Add the product of the integer to the quotients produced by the parts, and the sum, 310 dollars, 47 cents, 7 mills, is the answer.

2. 16 lb. 5 oz. 16 dwts. 4 grs. at 29 cts. per pound. $ cts. m.
Ans. 4.78 +

3. 5 lb. 2 oz. 11 dwts. 17 grs. at 41 cts. " 2.13.8+

4. 2 lb. 1 oz. 12 dwts. 12 grs. at 64 cts. " 1.36.6+

5. 17 lb. 2 oz. 19 dwts. 16 grs. at 59 cents per lb. $ cts.m. Ans. 10.17.6.+

6. 34 lb. 1 oz. 11 dwts. 5 grs. at $1.16 per lb. 39.59.+

7. 5 C. 3 qrs. 6 lb. at 12 dollars, per ton. 3.48.6.

8. 7 C. 1 qr. 10 lb. at $4.80 cts. per. C. 35.28.

9. 16 C. 1 qr. 15 lb. at $4.12½ cts. per C. 67.65.

10. 1 A. 2 R. 12 P. at $25.60 cts. per acre. 40.32.

11. 5 Yds. 1 qr. 2 nas. 2 in. at $6.84 cts. per yard. 37.14½

12. 4 Bu. 2 P. 7 qts. at $1.28 cts. per bushel. 6.04

13. Bought 19 C. 3 qrs. 24 lbs. of iron, at 99 dolls. 99 cts. per ton: required the amount. Ans. 99 dolls. 94 cts.

14. If a yard of cloth cost $4.91 cts., what is the value of 69 yds. 2 qrs. 2 nails? Ans. 341.85875 dolls.

15. What is the value of 12 Bu. 2 P. 1 qt. of oats, at 39½ cents per bushel? Ans. $4.95 cts. nearly.

16. If land be rated at 42 dollars per acre, what is the value of a plantation containing 243 A. 3 R. 10 P.?

Ans. $10240.12½ cts.

17. If corn sell for 52 cents per bushel, what must I pay for 16 bushels, 3 quarts? Ans. 8.36875 dolls.

QUESTIONS FOR EXERCISE

In the preceding Rules.

1. Five auditors, in a public office, receive 70 dollars a quarter, for which they attend 7 times during that period; but if one or more be absent at any time, then the absent persons' shares are divided among those who attend. A. and B. never miss attendance on these occasions; but C. and D. are absent four times, viz: the first, third, fifth and seventh days of meeting. E. is absent three times, viz: the second, fourth and sixth days. When payment becomes due, I wish to know what each is to receive.

Ds. ds. $ $
As 7 : 1 :: 70 : 10 The wages for each day's attendance.

Aud. Aud. $ $
As 5 : 1 :: 10 : 2 Each auditor's wages for one day.

C. and D. were each absent four days, when each of the other three were in attendance; therefore, their wages for the

time of their absence (which are 16 dollars) must be equally divided hetween A. B. and E.

Aud. Aud. $ $ cts.
As 3 : 1 : : 16 : 5.33⅓ Coming to A. B. and E. each.

E. was absent three days, when each of the others were in attendance; therefore, his wages for these three days, which is six dollars, must be equally divided between A. B. C. and D.

Aud. Aud. $ $ cts.
As 4 : 1 : : 6 : 1.50 . Coming to A. B. C. and D. each.

A's wages for the term, viz: 7 days, at 2 dollars per day,	$14.00 cts.
Share of C's and D's wages,	5.33⅓
Share of E's wages,	1.50
A. receives	20.83⅓
B's wages for the term, viz: 7 days, at 2 dollars per day,	$14.00 cts.
Share of C's and D's wages,	5.33⅓
Share of E's wages,	1.50
B. received	20.83⅓
C's wages, viz: 3 days, at two dollars per day,	$6.00 cts.
Share of E's wages,	1.50
C. received	7.50
D's wages, viz: 3 days, at two dollars per day,	$6.00 cts.
Share of E's wages,	1.50
D. received	$7.50
E's wages, viz: 4 days, at two dollars per day,	$8.00 cts.
Share of C's and D's wages,	5.33⅓
E. received	13.33⅓

2. The Spectator mentions a club of fat people, whose number was only 15, and yet weighed three tons: what was the weight of each person, on an average. Ans. 4 cwt.

3. What quantity of lining, 3 qrs. of a yard wide, will it take to line 7½ yards of cloth, 1½ yards wide?

Ans. 15 yards.

4. What quantity of stuff, that is 3 qrs. of a yard wide, will line 17 yards of silk, that is 6 qrs. wide? Ans. 34 yds.

5. I demand the amount of 50 cords, 21 feet of bark, at 7 dollars, 50 cents per cord. Ans. 376 dolls. 23 cts.

6. If 5 men can make 240 pair of shoes in 30 days, how many men can make 1200 pair in 75 days? Ans. 10 men.

7. If 3 men can do 18 rods of ditching in 6 days, how many rods may be done by 24 men in 8 days? Ans. 192.

8. The breadth of a river is required—at one side of which, A. firing a gun, B. directly opposite, at the other, counts 6 pulsations at his wrist, between seeing the flash and hearing the report. Ans. 1 mile, 67.2 yards.

9. Bought 104 bushels, 3 pecks of potatoes, at 31¼ cents per bushel, what do they amount to? Ans. $32.734375.

10. The earth's orbit, or track, which it describes round the sun in 365 days, 6 hours, is computed, by astronomers, to be about 596900000 miles—How far, then, per minute, must we be carried through the firmament by this wonderful motion?

Ans. 1134 miles, 7 furlongs.+

11. What will a yard of cloth cost, when 4 pieces, each containing 21 yards, cost 504 dollars? Ans. 6 dolls.

12. Bought a granary of wheat, containing 100 solid feet, at the rate of one dollar per bushel: I wish to know the cost of it. Ans. 80 dolls. 35 cts. 6 m.

13. Bought 4 sections of land, for four thousand dollars—How much do I pay per acre? Ans. $1.56¼ cts.

14. Sold 4 sections of land, at $1.93¾ cts. per acre—How much does it amount to? Ans. 4960 dollars.

15. Laid out 500 dollars in hats, at 2 dolls. 50 cts. a piece—How many do I receive? Ans. 200.

16. A. and B. depart from the same place, at the same time. A. travels due west, at the rate of 30 miles per day. B. travels due east, at the rate of 25 miles per day. A. is detained, by indisposition, 4 days; and B. after having proceeded on his journey 40 miles, returns for some articles of wearing apparel; remains at home one day, and undertakes his journey anew. I wish to know how far they are apart at the end of ten days; also, how far would they be apart if they had both been travelling due east or west?

Ans. 325 miles; E. or W. 35 miles.

17. Laid out 300 dollars for wheat and rye: the value of the wheat was 250 dollars, and the quantity of rye 100 bushels; also, for every 5 bushels of wheat there were 2 of

rye—How many bushels of wheat were there, and what was the value of a bushel of each?

Ans. 250 bushels of wheat, at 1 dollar; rye, 50 cts.

18. Bought a quantity of cloth, at the rate of $12.80 cts. for every 3 yards; of which a certain part was sold at the rate of $25.25 cts. for every 5 yards, and gained thereby as much as 105 yards cost—How many yards were sold?

Ans. 571 yds. 3 qrs. 2 nas.+

19. Bought 5 pipes of wine, containing 120½, 126¼, 125, 127¾ and 128½ gallons: the price of the two first was $1.50 cts. per gallon, and the three last, $1.75 cts. per gallon. I wish to know the amount. Ans. $1037.31¼ cts.

20. If 12 men in 4 days mow 72 acres of grass, how many acres will 2 men mow in one day? Ans. 3.

21. Bought 574 bushels of lime, at 11 dolls. 87½ cts. per hundred bushels—How much does it amount to?

Ans. $68.1625.

22. Sold 535 bushels of lime for 12.5 cts. per bushel—How much does it amount to? Ans. $66.87½ cts.

23. A farmer, having sown 12 bushels, found that it produced 150 bushels the first year: now, supposing he sows 20 bushels of grain, each year, for 16 years successively, what will be his whole increase at the expiration of the last year?

Ans. 4000 bushels.

24. If 1½ pounds of pork sell for 6¼ cents, what is the value of 6¼ pounds? Ans. 26 cts. 04 m.+

25. What will 59 pounds of cheese come to, at 7¼ cents per pound? Ans. $4.27¾ cts.

26. What is the value of 1 yard, 1 quarter, 1 nail, 1¼ inches of broad cloth, at the rate of $5.97½ cts. for 1¼ yards?

Ans. $6.44 cts. nearly.

27. If eggs sell at 6¼ cts. per dozen, how much is that for one hundred eggs? Ans. 52 cts.+

28. If a basket of sweet potatoes, containing 3 pecks, sell for 43¾ cents, how much is that per bushel? Ans. 58⅓ cts.

29. What must I pay for 1674 bricks, at $5.40 cts. per thousand? Ans. $9.04 cts. nearly.

30. Paid one cent a piece for 2548 cedar shingles; twenty cents per hundred for carriage, and 70 cents per thousand for jointing—How much do they stand me in?

Ans. $32.36 cts. nearly.

31. If the pasturing of 5 head of cattle, 5 weeks, be $6.25 cents, how much will the pasturing of 117 head come to, in 4 weeks? Ans. 117 dollars.

32. What is tobacco an ounce, when 5 cwt. 3 qrs. 7 lbs. 4 oz. 8 dr. sell for $93.16½ cents? Ans. 1 cent.

33. What will 1½ pecks of the Siberian crab apple come to, at 18¾ cents per quart? Ans. $2.25 cts.

34. At $1.57½ cts. per barrel, what is cider per gallon?
Ans. 5 cts.

35. A horse and cow can eat a certain stack of hay in 21 days; the cow can eat the same quantity in 70 days—How long would it take the horse alone? Ans. 30 days.

36. What will 27 Cwt. 3 qrs. 1 lb. of buckwheat flour come to, when 4½ cwt. sell for 15 dollars?
Ans. $92.53⅓ cts.

37. If a barrel of mackerel, containing 175, cost six dollars; how much is the cost of half a dozen?
Ans. 20½ cents.+

38. Suppose an innkeeper buys one barrel of brandy at two dollars per gallon, and afterwards retails it out at 12½ cents per gill—I demand what it sold for, (allowing a waste of one gill per gallon); and what he gained thereon.
Ans. Sold for $122.06¼ cts.
Gained, $59.06¼ cts.

39. If I borrow of my friend 11 dollars on the first of August, and pay him again on the first of October; and he have occasion to borrow 20 dollars of me on the first of November—When will the payment be due?
Ans. The 5th of December.

40. A person bequeathed to his widow 1000 dollars; to each of his five children 800 dollars; he had been 37½ years in trade, and had cleared (at an average) 80 dollars a year—What had he to begin with? Ans. $2000.

41. An oil-man bought 9 C. 1 qr. 20 pounds of oil—How many gallons were there; allowing 7½ lbs. to a gallon?
Ans. 126.

42. How many yards of cloth, at $4.25 cts. per yard, can I have for 16 C. 2 qr. 14 lb. of wool, at 35 cents per pound? Ans. 137.+

43. What is the value of 12 barrels of soap, at 6¼ cents per pound; each barrel containing 248 pounds? Ans. $186.00.

44. An usurer put out 75 dollars, for 12 months; and received for principal and interest $79.50 cts.—I demand at what rate per cent. he received interest. Ans. 6 per cent.

45. Bought 50 yards of cloth, for five times as many dollars, and sold them again for six times as many: but if the cloth had cost me as much as I sold it for, what should I have sold it for to gain after the same rate? Ans. 360 dollars.

INTEREST.

Interest is a premium allowed in the lending or forbearance of a sum of money, according to a certain rate per cent. agreed on for a determined space of time, which by law is generally limited to 6 per cent. per annum.

The principal is the money lent, for which interest is to be received.

Rate, or ratio, is the sum per cent. per annum agreed on.

The amount is the sum of principal and interest.

It is evident that the rate per cent. expressed decimally is the ratio; thus 6 per cent. = .06 the ratio; 6½ per cent. = .065 the ratio.

Interest is also applied to Commission, Brokerage, purchasing Stock, and Insurance.

Rule.

Multiply the principal by the ratio, and point off as many figures in the product as there are decimals in both factors, for the interest for one year, commission, brokerage, insurance, &c.

For more years than one: multiply the interest of one year by the number of years given in the question, and the product will be the answer.

For months, take the aliquot parts of a year; or for months and days, for the months take the aliquot parts of a year, and for the days, the aliquot parts of 30.44. Or reduce the months and days to the decimal of a year, which multiply by the interest of one year; the product will be the answer.

When the rate is six per cent., for months, multiply the principal by half the number of months, and remove the decimal point two figures to the left hand.

To find the interest of any sum for months, weeks or days, at any ratio.

Multiply the principal by the ratio, and that product by the number of months, weeks or days given: and divide this product by the months, weeks or days in a year for the answer. Or, as the months, weeks or days in a year are to the number given, so is the interest of one year, to the interest required.

Examples.

1. What is the interest of 56 dollars for one year, at 6 per cent. per annum?

$
56 principal.
.06 ratio.

3.36 interest. Ans.

2. Required the amount of a bond of $934.76, for four years, at 7 per cent.

$ 934.76 principal.
.07 ratio.

65.4332 interest of one year.
4 number of years.

261.7328 interest for four years.
934.76 principal.

1196.4928 amount. Answer.

3. Required the interest of $49.29 cts. for 3 years, 6 mo. and 22.83 days, at 6 per cent.

$49.29 principal.
.06 ratio.

M.		
6	½	2.9574 interest for one year.
		3
da.		8.8722 int. for 3 years.
22.83	⅙	1.4787 for 6 months.
		1848375 for 22.83 days.
		10.5357375 Answer.

4. Required the amount of a bond of 604 dollars, for 10 months, at six per cent. per annum.

$	
604	principal.
5	half the number of months.
30.20	interest.
604	principal.
634.20	amount.

5. What is the interest of 108 dollars, for 11 months, at 7 per cent.?

$	
108	principal.
.07	ratio.
7.56	
11	the months given.

Months in a year 12)83.16

6.93 Answer.

6. What is the interest of 700 dollars, for 2 weeks, at 6 per cent.?

$700	principal.
.06	ratio.
42.00	
2	the weeks given.

Number of weeks in a year, 52.17857)84.00000(1.609. Ans.
52.17857

31821430
31307142

51428800
46960713

4468087

7. Required the interest of $365.25 cts., for 75 days, at 5 per cent.

$365.25 principal.
.05 ratio.

18.2625
75 given number of days.

913125
1278375

The days in a year, 365.25)1369.6875($3.75. Answer.
109575

273937
255675

182625
182625

8. Bought goods for a friend, to the amount of $537.42, at 1½ per cent commission; required my demand.

$537.42
.015 ratio.

268710
53742

8.0613 Answer.

9. What is the interest of $456.27 cts. for 5 years, at 6 per cent.? Ans. 136.881 dolls.

10. Required the amount of $127.40. for 3 years 12 days, at 7 per cent. Ans. $154.447.

11. Calculate the interest due on a bond of 5764 dollars, for 16 months, at 5½ per cent. Ans. $422.69⅓.

12. My correspondent writes me word, that he has bought goods to the amount of 1112 dollars, on my account, what does his commission come to, at 3½ per cent.? Ans. $38.92.

13. What is the interest of 1000 dollars, for 16 years, 7 months and 30 days, at 6 per cent. per annum? Ans. $999.92.8.

14. What is the interest of 135 dollars, for 10 days, at 5 per cent.? Ans. 18¾ cents, nearly.

15. Required the interest on a bond for 1000 dollars, given

the 11th day of March, 1830, and taken up the first day of August, 1835, at 6 per cent. per annum.

Ans. $323.45 dolls. nearly.

16. What is the amount of 400 dollars, for 4 years, 5 months and 12 days, at 5 per cent.? Ans. $488.99 +

17. What will $4264.71 amount to in 10 years, at $4\frac{1}{2}$ per cent. per annum? Ans. $6183.8295.

18. What is the interest of one dollar, for 61 days, at 6 per cent.? Ans. 1 cent.

19. What is the amount of one dollar, for 1461 days, at 6 per cent. per annum? Ans. $1.24.

20. Required the value of a fifty dollar bank note, that is 5 per cent. below par. Ans. $47.50 cts.

21. Required the amount of a note of hand for 11 dollars for two months, at 6 per cent. Ans. $11.11 cts.

22. What is the interest of 130 dollars for 100 days, at 6 per cent.? Ans. 2.13\frac{1}{3}$ cts.

23. What is the interest of 500 dollars for $8\frac{3}{4}$ months, at $6\frac{1}{2}$ per cent.? Ans. 23.69\frac{3}{4}$ +

24. Required the value of $1750, United States Bank stock, at 125 per cent. Ans. $2187.50 cts.

25. What is the amount of 1691 dollars for one day, at $7\frac{1}{2}$ per cent. per annum.? Ans. $1691.347.

26. An uncle left, by will, to his niece, 1500 dollars; at the time of her marriage, there were 5 years interest due on the legacy, at $5\frac{1}{4}$ per cent. per annum—What sum must her executor pay? Ans. $1893.75 cts.

27. Required the interest of $99.99 cts. for 366 days, at 6 per cent. Ans. $6.01 cts.

28. What is the interest of 125 dollars, for one year, 3 months and 12 days, at 6 per cent. per annum?

Ans. $9.62 cts.

29. If I allow my factor $2\frac{3}{4}$ per cent. for commission, what may he demand on the laying out of 976 dollars, 28 cents?

Ans. 26.84\frac{3}{4}$ cts.

30. If a broker is employed to buy a quantity of goods, to the value of 652 dollars, what is the brokage at $1\frac{1}{4}$ per cent.?

Ans. $8.15 cts.

31. When a broker sells goods to the amount of 1008 dollars, what may he demand for brokage, if he is allowed 90 cents per cent.? Ans. $9.072.

32. What is the purchase of 9748 dollars, bank stock, at 108¾ per cent.? Ans. $10600.95 cts.

33. What is the interest of 950 dollars, for 20 weeks, at 6 per cent.? Ans. $21.848.

34. What is the amount of 50 dollars, for 16 years and 8 months, at 6 per cent. per annum? Ans. $100.00

35. What is the amount of 100 dollars, for 20 years, at 5 per cent. per annum? Ans. $200.00.

On computing interest on notes, &c.

We have no special acts of Assembly on this subject.—Chief Justice M'Kean, in 1785, fixed upon the following rule for calculating interest, [see 1st Dallas, p. 124] viz. That the interest of the money paid in before the time, be deducted from the interest of the whole sum due at the time appointed by the instrument for making the payment.

Examples.

1. A note, dated January 1st, 1835, was given for 160 dollars, payable in one year, with 6 per cent. interest; and on the first of July following, was paid 100 dollars—What balance remains due on said note, January 1st, 1836?

The note, - - - - - - -		$160.00
One year's interest, - - - - - -		9.60
Whole sum due at the time appointed for the payment, - - - - - -		169.60
July 1st, 1835, By cash, - -	$100.00	103.00
Jan. 1st, 1836, By int. of $100.00,	3.00	
Balance due Jan. 1st, 1836,		$66.60

2. A. received of B. his note for 400 dollars, dated July 1st, 1834, payable in 15 months, with six per cent. interest; and January 1st, 1835, A. received of B. 300 dollars, which A. credited on said note—What sum must B. pay to A. on the first of October, 1835? Ans. $116.50 cts.

3. A note, dated January 1st, 1835, was given for $160.00, on demand, bearing interest at six per cent.; and on the first of July following, was paid 100 dollars—What balance remains due on said note, January 1st, 1836?

The note, - - - - - - -	$160.00
Interest of $160 for 6 months, to July 1st, 1835,	4.80
Amount of the note at the payment, - -	164.80
Deduct the payment made, - - -	100.00
Balance of the note after the first payment,	64.80
Interest of $64.80 cts. for 6 mos. to Jan. 1st, 1836,	1.944
	$66.74.4

4. A note, dated July 1st, 1834, was given for 400 dollars, on demand, bearing interest at six per cent.; and on January 1st, 1835, was endorsed a payment of $300.00: I demand how much remained due on said note on the first of October, 1835? Ans. $117.04.

When partial payments are endorsed before the note becomes due, this rule is applicable; but in all other cases, the resort must be made to the rule of court for the district where the business is transacted. [See the difference in the first and third, also in the second and fourth examples: the balance due on the fourth, being $117.04 cts. in consequence of the note being on demand and due at the time the first payment was made; and the balance due on the second, only $116.50, in consequence of the note not being due at the time the first payment was made.]

Rule of Courts for computing Interest.

If it be one year or more from the time interest commenced to the first payment, add the interest for the time to the principal, deduct the payment from this amount: if there be after payments made, add the interest on the balance due, up to the next payment to the said balance; deduct the payment from the amount as before, and so proceed from one payment to another, until all the payments are absorbed, provided the time between one payment and another be one year or more. But if any payment be made before one year, s interest hath accrued, compute the interest on the principal sum due on the obligation for one year, add it to the principal, and compute the interest on the sum paid from the time it was paid up to the end of the year; add it to the sum paid,

and deduct that sum from the principal and interest added as before.

If any payments be made of a less sum than the interest arisen at the time of such payments, no interest is to be computed, but only on the principal sum for any period.

Examples.

1. A bond, dated January 1st, 1832, was given for 500 dollars, at 6 per cent. interest, on which were endorsed three equal annual payments, of $187.05½ cts. each. I wish to know if any thing remains unpaid.

$	
500	Principal.
.6	Ratio.
30.00	Interest the first year.
500	
530.00	Amount.
187.055	First payment.
342.945	Balance after first payment.
.06	
20.57670	Interest on balance.
342.945	
363.5217	
187.055	Second payment.
176.4667	Balance after second payment.
.06	
10.588002	Interest on balance.
176.4667	
187.055	
187.055	Third payment.
0.00	Ans. The full amount is paid.

2. A bond dated April 1st, 1831, was given for $266.50 cts. at 6 per cent. interest, and there were payments endorsed

upon it as follows, viz: first payment, $50 October 1st, 1831; second payment, $100 January 1st, 1833; third payment, $150 April 1st, 1835. I demand how much remains due on said bond the first day of January 1836? Ans. $9.16 cts.

3. A bond was given on the first of January, 1835, for $1200, and there were payments endorsed upon it as follows, viz: first payment 600 dollars, July 1st, 1835; second payment, October 1st, 1835, of 400 dollars; required the balance due on the 1st of January, 1836, interest at 6 per cent. per annum. Ans. 248 dollars.

4. A note was given on the 10th of June, 1835, for 56 dollars 50 cents, and 25 dollars paid thereon on the 25th of September following: I demand the sum due on the 25th of December, 1835, at which time the note was taken up and paid off—interest at 7 per cent. per annum. Ans. $33.20½.

CASE II.

To find the principal, when rate per cent., time and amount are given.

Rule.

As the amount of $100, at the rate and time given,
Is to the amount, (or sum given,)
So is $100,
To the principal required.

Or, add 100 to the product of the time and rate per cent. for a divisor; and annex two ciphers to the amount, for a dividend; the quotient from thence arising will be the principal, (or present worth.)

Note—If the time be not years, reduce it to the decimal part of a year, or years and decimal parts.

Examples.

1. What sum at interest for 11 years, will amount to $453.18 cts. at 6 per cent. interest?

$100
.06
6.00
11
66 interest of $100 for 11 years.
+100
166 amount of $100 for 11 years.

$	$ Cts.	$
As 166	: 453.18	:: 100

100

$

166)4531800(273 Ans.
332

1211
1162

498
498

Or thus by rule 2.

6 rate per cent.
11 time.

66
100

166 divisor.

$453.18
100

$

166)4531800(273 Ans.
332

1211
1162

498
498

2. What principal, at interest for 2 years, at 5 per cent. will amount to 253 dollars? Ans. $230.

3. What sum, being put to interest for 5 years, at 7 per cent. will amount to $275.40 cts.? Ans. $204.

4. What principal at interest will amount to $11048.89½ cts. in one year and nine months, at 6 per cent.?

Ans. 9999 dollars.

5. What sum at interest for 16 years, at 4 per cent. interest, will amount to $656? Ans. $400.

6. A man at his decease bequeathed a certain sum to his son, whose age then was 17 years and 8 months, to be put at interest at 6 per cent. until he should arrive at the age of 21 years, which his guardian then found to be $815.85 cts.—I wish to know how much was bequeathed by his father.

Ans. $666.

CASE III.

To find the rate per cent. when the principal, time and amount are given.

Rule.

Deduct the principal from the amount, and the remainder will be the interest for the whole time: then say,

As the product of the time and principal
Is to $100,
So is the interest for the whole time
To the rate per cent.

Examples.

1. At what rate per cent. will 674 dollars amount to $754.88 cts. in 2 years?

$674	principal.	$754.88	amount.
2	years.	674	principal.
1348	product.	80.88	interest.

	$		$		$ cts.
As	1348	;	100	::	80.88
					100

1348)8088.00(6. Ans.
8088

2. At what rate per cent. will 666 dollars amount to $815.85 cts. in 3 years and 9 months? Ans. 6.

3. At what rate per cent. will 400 dollars amount to $656 in 16 years? Ans. 4.

4. At what rate per cent. will 9999 dollars amount to $11048.89½ cents, in 1 year and 9 months? Ans. 6.

5. At what rate per cent. will 204 dollars amount to $275.40 in 5 years? Ans. 7.

6. At what rate per cent. will $1.50 cts. amount to $2.10 cts. in 8 years? Ans. 5.

7. At what rate per cent. will $273 amount to $453.18 in 11 years? Ans. 6.

CASE IV.

To find the time, when the rate per cent. principal and amount are given.

RULE.

As the interest of the principal for one year, at the given rate per cent.
Is to the whole interest,
So is one year,
To the time required.

Or, divide the whole interest by that of the principal for one year, and the quotient will be the time required.

Examples.

1. In what time will 347 dollars amount to $419.87, at 6 per cent. per annum?

$419.87 amount.
347.00 principal.
72.87 whole interest.

$ $ yr.
As 20.82 : 72.87 :: 1
1

2082)72.87(3.5 = 3½ years
6246
10410
10410

$347
6
20.82 interest for 1 year.

Ans.

2. In what time will 674 dollars amount to $754.83, at 6 per cent. per annum? Ans. 2 years.

3. In what time will 666 dollars amount to $815.85, at 6 per cent. per annum? Ans. 3 years, 9 mo.

4. In what time will 400 dollars amount to 656 dollars, at 4 per cent, per annum? Ans. 16 years.

5. In what time will 9999 dollars amount to $11048.89½, at 6 per cent. per annum? Ans. 1 year, 9 mo.

6. In what time will 204 dollars amount to $275.40, at 7 per cent. per annum? Ans. 5 years.

7. In what time will 273 dollars amount to $453.18, at 6 per cent. per annum? Ans. 11 years.

REBATE OR DISCOUNT.

REBATE OR DISCOUNT is an abatement for the payment of money before it becomes due, by accepting such a sum as would, if placed at interest, amount to the whole debt at the time payable. This sum is called the present worth.

RULE.

Annex two ciphers to the amount or given debt for a dividend; add 100 to the product of the rate per cent. and time for a divisor, and the quotient arising from thence will be the present worth: or work by rule 1st, case 2d, Interest.

Or, add 100 to the product of the rate per cent. and time, for a divisor; and the continued product of the amount, rate and time, for a dividend; the quotient will be the discount.

Note—The time must be computed in years.

Examples.

1. What sum must I pay for a note of $218.22½ cts. due 3 months hence, discount at 6 per cent.?

		$
	101.5)21822.5(215	Ans.
6	rate per cent.	2030
.25	time in decimal parts of a year.	———
———		1522
1.50		1015
100		———
———		5075
101.5	divisor.	5075

Note.—When there are cents in the given debt, instead of annexing two ciphers, consider the cents placed instead thereof.

2. What is the discount on a note for 242 dollars, due two years hence, at 5 per cent. discount?

5	rate per cent.	$242	amount.
2	years.	5	rate per cent.
—		—	
10		1210	
100		2	
—		—	
110	divisor.	110)2420	
		$22	discount.

3. What is the present worth and discount of 100 dollars, for one year and six months, at 6 per cent.?

Ans. Present worth, $91.7431; discount, $8.2569.

4. What is the present worth of 574 dollars, one half payable in one month, and the other half in one year?

Ans. $556.32.7.

5. Bought a quantity of goods for 305 dollars, at a credit of 5 months, and sold the same immediately for 300 dollars cash—How much do I gain by the sale, allowing discount at 6 per cent.? Ans. $2.44 cts.

6. How much ready money should I receive for a note of 92 dollars, due 17 months hence, at 5 per cent. discount?
Ans. $85.914.

7. What is the discount on a note of 10 dollars, due in 3 months, discount at 8 per cent.? Ans. 19 cents, 6 m.

BANK DISCOUNT.

It is customary at banks to allow three days of grace; therefore, when a note is discounted at bank for 60 days, (that is, payable 60 days *after* date,) the discount is computed thus:—

For 1 day on which the note is discounted;
" 60 days which it has to run *after* that day; and
" 3 days of grace.

For 64 days in all; as ROWLETT, formerly accountant in the Bank of North America, says in the introduction (page 9) to his celebrated Tables of Discount and Interest: "It is usual with the banks to reckon days *inclusively* upon all notes, thus the day on which a note is discounted and the day on which it becomes due, are both calculated upon."

Bank discount is 6 per cent. per annum; reckoning, when for days, the year as twelve months of *thirty days* each, equal to exactly 1 per cent. for 60 days. It is then either computed by multiplying the principal, or given sum in dollars, by the number of days which the note has to run *after* the day on which it is discounted, *that* day and the three days of grace, and dividing by 6 for the answer in mills: or, which is shorter, by counting off (when those days together amount to 64) two decimal figures, in the sum of the principal, from the right to the left, which will then stand in dollars and cents for the discount of the 60 days, and by adding the 15th part for the 4 days. The discount being computed on the whole sum, a second excess arises, which is deducted,

and the balance only advanced to the holder; thus interest is charged on the part deducted, as well as on the part advanced. In large sums such excess amounts to something considerable.

Examples.

1. What is the discount on 600 dollars, for 60 days?

$
600
64 time, including the days of grace and first day.

2400
3600

6)38400

6.40.0 Answer.

Or, 6.00
Add the 15th part 0.40

$6.40 Ans.

2. B borrowed of the Westchester bank, 1000 dollars, for 60 days; required the amount he must receive.

$
1000
64 time, including the days of grace and day on which discounted.

6)64000

10.666 or $10\frac{2}{3}$ discount.

1000
10.67

$909.33 sum he must receive.

10.00
The 15th part, 67

$10.67

Note—In case it be not convenient to pay off the note at the proper time, a new note must be presented on the day of discount, immediately preceding the expiration of the time, and the same discount paid as before.

Examples.

1. A man borrowed of bank 1200 dollars for 30 days, and it not being convenient to pay the money at the proper time, he renewed his note for another 30 days—Required the sum he has to pay more by renewing his note, than if he had taken the money out for 60 days at first.

$1200	1200	12.80 for 64 days
add $\frac{1}{15}$ 12.80	34	off, 6.00 for 30 days
discount when drawn		
for 30 days.	4800	6.80
	3600	
	6)40800	

6.80 disc'nt when drawn for 30 days.
2
13.60 discount for 2 thirty days.
12.80 discount for 60 days.

So that he has .80 cents more to pay by drawing his note twice for 30 days, than if he had drawn it for 60 days at first.

3. What are the proceeds of a note for 1000 dollars—

At 3 months, or 90 days?

Days,			$1000.00
64	=	10.67	
30	=	5.00	
94			15.67
			$984.33

At 4 months, or 120 days.

Days,			$1000.00
64	=	10.67	
60	=	10.00	
124			20.67
			979.33

At 116 days—(to bring it due upon the same weekly discount-day, 17 weeks from that on which it is first discounted, and make the discount an even sum.)

Days.		$
116		1000
4		
120	=	20
		$980

4. If I borrow 500 dollars at bank for 30 days, and at the expiration of that time get it renewed for 30 days longer, what is the discount thereon? Ans. $5.66.

EXTENSIVE ADDITIONS.

The following method of adding together large sums will be found very convenient, and may be practised with advantage in banks and other large monied establishments; and more particularly when the accountant is subject to frequent interruptions: because, if any error be made in summing up any particular column, it has no dependence on any other column, and may be detected without interfering with it.

Rule.

Add each column by itself, and place the respective aggregates in such manner that units may stand under units, tens under tens, hundreds under hundreds, &c. Then, by adding together these aggregates, you have the whole sum.

Note.—It makes no difference whether we begin at the right hand, left hand, or middle column.

Examples.

$ 51.94		$ 19.20
123.12		12.50
12.41		13.27
54.70		14.61
355.16		714.32
4271.13		16.12
715.78		71.54
43.82		1.12
769.51		1654.23
27.69		16.22
5.43		124.17
13.97		14.74
5126.43		6.30
49	= sum of first column.	34
66	= sum of second column.	40
54	= sum of third column.	54
41	= sum of fourth col.	22
21	= sum of fifth col.	14
9	= sum of sixth col.	1
$11571.09	= sum total.	$2678.34

The use of the preceding method of addition in bank accounts.

Am't of notes.	Discounts for 60 days.	Proceeds of notes.
1500	$16.00	$1484.00
1800	19.20	1780.80
1248	13.31	1234.69
900	9.60	890.40
200	2.13	197.87
500	5.33	494.67
1200	12.80	1187.20
100	1.07	98.93
250	2.67	247.33
3000	32.00	2968.00
450	4.80	445.20
750	8.00	742.00
150	1.60	148.40
600	6.40	593.60
800	8.53	791.47
700	7.47	692.53
400	4.27	395.73
300	3.20	296.80
550	5.87	544.13
8	45	45
29	68	83
81	87	85
7	7	134
		78
15398 notes.	164.25 discounts.	6
		15233.75 proceeds
		164.25 discounts

Amount of proceeds and discounts, = 15398.00

N. B. Discount charged on each for 64 days, as explained on page 113.

By the nature of the above account, it is evident that the amount of the notes must be equal to the discounts and proceeds. If any error has arisen, it may perhaps be discovered by going over one rank of the figures.

LOSS AND GAIN.

Loss and Gain is a rule that discovers what is gained or lost in the buying or selling of goods; and instructs us to rise or fall in the price, so as to gain or lose so much per cent. or otherwise.

Rule.

Work by the Rule of Three or Practice, as the nature of the case may require.

Examples.

1. If for ready money I could buy cloth at 5 dollars per yard, and sell the same on three months credit, at 6 dollars per yard, what would be my gain per cent.?

$100
6

3 | ¼ | 600
150 int. of $100 for 3 mo.
100.

101.50 am't of $100, 3 mo.

As 101.50 : 6 :: 100
100

101.50)600.00(5.91.1
50750 5.00.0

92500 .91.1 gain
91350 per yd.

11500
10150

13500
10150

3350

$ $ $
As 5 : 100 :: .911
100

5)91100

18.22 gain per cent.

Note.—When goods are bought or sold on credit, the present worth of their value must be found, in order to find the true gain or loss.

2. If 296 yards of broadcloth be sold for $1184, at 25 per cent. profit, what was the prime cost per yard? Ans. $3.20.

3. Bought 51 yards of cloth at $3.23 per yard, and sold the same for $200: required the gain per yard?

Ans. 69 cts.+

4. If one dozen hats cost 50 dollars, how must I sell them singly to gain 20 per cent. Ans. 5 dollars.

5. If 90 yards of silk sell for $100, how must I sell it per yard, to gain 12½ per cent. Ans. $1.25.

6. Bought broadcloth for 3 dollars per yard, and sold it

again at an advance of 25 per cent.—What was that per yard? Ans. $3.75.

7. Paid $175 for a ton of steel—What is the profit or loss on the sale thereof at 10 cents per pound, computing 25 pounds for a quarter of a hundred weight?

Ans. $25 profit.

8. If a yard of cambric cost 80 cents, and I sell it again for 95 cents—What do I gain per cent.? Ans. $18\frac{3}{4}$.

9. Bought a cask of oil, containing 77 gallons, for 91 cts. per gallon; but, by accident, 28 gallons leaked out—How must I sell the remainder, per gallon, so as to sustain no loss?

Ans. $1.43.

10. If I buy 431 pounds of wool, at 34 cents per pound, and sell it for 144 dollars: do I gain or lose, and how much?

Ans. I lose $2.54.

11. Bought a barrel of vinegar, for 3.93\frac{3}{4}$, and retail it out at 25 cents per gallon—What do I gain per cent., allowing no waste in the measure? Ans. 100.

12. Bought a watch for 15 dollars, and sold the same immediately for $21, at 10 months' credit: required the gain per cent. in ready money, and what is the gain per cent. per annum? Ans. gain in ready money, $33\frac{1}{3}$ per cent.; per annum, 48 per cent.

13. A vintner bought 63 gallons of wine, at $1.10 per gallon, and sold it again for 45 cents per quart: I demand what he gained in the whole, and what he gained per cent.?

Ans. whole gain, $44.10; gain per cent. $63.63.

14. If by selling cotton yarn at 18 cents per pound, there is 2 cents per pound loss, what is the loss per cent.?

Ans. 10 per cent.

15. Sold goods on a credit of 9 months, for 160 dollars, which cost me $150 cash: do I gain or lose by this transaction, and how much? Ans. I gain, in ready money, $3.11.

16. Bought 4 pieces of broadcloth, each piece containing 12 yards, at the rate of 47 dollars for every 12 yards: do I gain or lose by selling the same at the rate of $19 for every 5 yards? Ans. I lose $5.60 cts.

17. Bought cloth for $1.90 per yard, which I find, on examination, to be of an inferior quality to what I expected, and I must lose 20 per cent. by it—What will I then sell it for per yard? Ans. 1.58\frac{1}{2}$.

18. If I buy 147 pounds of tea, at one dollar per pound, and sell 98 pounds of it at 80 cents per pound, and the remainder at $1.10 per pound: do I gain or lose, and how much? Ans. I lose $14.70.

19. If I buy 1 cwt. 2 qrs. of tobacco, for $22.50 cts. and sell the same for 14½ cents per pound: whether do I gain or lose? Ans. I lose 75 cents.

20. Bought 20 pieces of cloth, at 10 dollars per piece, and afterwards sold 9 of them at 12 dollars per piece, and 6 at 8 dollars per piece: at what price must I sell the remainder to gain $16.00 on the whole? Ans. $12.00 per piece.

21. Sold 1 cwt. 2 qrs. 10 lbs. of hops, for $9.60, at the rate of 20 per cent. profit—What would have been the gain per cent. if I had sold them for $5.50 cts. per hundred weight? Ans. 10.

22. Bought 250 yards of cloth, for $510.00; retailed the same at $2.50 per yard—What is the profit in the whole, and how much per cent.?

Ans. whole gain, $115.00; gain per cent. $22.568.

23. Cloth bought at $2.50 per yard, and sold at 3 dollars per yard—What is gained per cent.? Ans. 20 per cent.

24. If a barrel of mackerel, containing 175, cost $5.50—What is gained by retailing them at 5 cents a piece? Ans. $3.25.

25. If 1½ herring cost 1½ cents, what is gained by selling one hundred for 1½ cents a piece? Ans. 50 cts.

BARTER,

Is the exchanging of one commodity for another, according to the prices agreed upon between the parties trading.

Rule 1st.—Find the value of that commodity whose quantity and price is given; then find what quantity of the other, to be received in exchange, at the price it is rated at, will amount to the same value.

2d.—When the quantities of two commodities are given, and the rate of selling them—in case there be a difference in the value, and some other commodity is to be given to make up this difference—find the value of the two given commodities separately; deduct the less from the greater; then will

the difference be the value of the third commodity, which divide by its price per pound, yard, &c. for the quantity.

3d.—When one has goods at a certain price, ready money, but, in bartering, advances it to something more, find what the other ought to rate his goods at, in proportion to that advance, and then proceed by rule 1st.

Examples.

1. What quantity of rye flour, at $2.50 per C. must be given for 5 C. of wheat flour, at $4 per C.?

C.
5
4

20 Value of the wheat flour.

C.
And 2.50)20.00(8 of rye flour. Answer.
20.00

2. A has 15 pieces of cloth, each piece containing 32 yards, at $2.40 per yard, for which B. is to give him 145 barrels of wheat flour, at $6.00 per barrel, and the remainder in pork, at 5 cents per pound—How many pounds of pork must A. receive?

Pieces.	Barrels.	
15	145	
32	6	
30	870	Value of the flour.
45		
480		
2.40		
192		
96		
1152.00		Value of the cloth.
870.00		Value of the flour.
05)282.00		Value of the pork.
5640		Answer.

3. A. has 240 pounds of wool, worth 36 cents per pound, ready money, but in barter will have 44 cents per pound; B. has cheese, worth 9 cents per pound, which he raises in proportion to A's wool—what is the barter price of B's wool, and how much cheese must he give to A. for his 240 pounds of wool?

cts. cts. cts.
As 36 : 9 :: 44
9

36)396(11 Ans. The barter price of B's cheese.
36

36
36

lbs.
240
.44

960
960

11)105.60 Value of A's wool.

960 lbs. of cheese coming to A. Ans.

4. How many pounds of sugar, at 11 cents per pound, must be given for 132 pounds of tobacco, at 17 cents per pound? Ans. 204 lbs.

5. A. has silk at $1.50 per yard, which he barters to B. for 150 yards of broadcloth, at $2.00 per yard—How much silk must B. receive? Ans. 200 yds.

6. A. gives B. 10 bushels of clover seed, at $3.50 per bushel, for 50 bushels of rye—How much per bushel does the rye stand him in? Ans. 70 cts.

7. A. has beeswax, at 25 cents per pound, ready money, but in barter will have 30 cents per pound; B. has chocolate, at 15 cents per pound, ready money—What price must the chocolate be in barter, and how much chocolate must be bartered for 75 pounds of beeswax?

Ans. the chocolate in barter, 18 cts. per lb. and 125 lbs. of chocolate must be given for 75 lbs. of beeswax.

8. B. has coffee, which he barters with C. at 6 cents per pound more than it cost him, against tea, which stands C. in 70 cents per pound, but puts it to $1.00. I demand how much the coffee did cost at first. Ans. 14 cents.

9. Two merchants barter: A. has 9 C. of tobacco, at 18 cents per pound, and B. has 40 yards of broadcloth, at 5 dollars per yard: which of them must receive money, and how much? Ans. B. must receive $38.

10. A merchant has 500 yards of muslin, at 12 cents per yard, which he barters for silk, at $1.50 per yard—How many yards must he receive? Ans. 40.

11. If A. hath cotton at 15 cents per yard, how much must he give A. for 165 pounds of candles, at 10 cents per pound? Ans. 110 lbs.

12. C. has nutmegs, worth 80 cents per pound, ready money, but in barter will have $1.00 per pound; and D. has rice, worth 4 cents per pound, ready money—How much must D. rate his rice at per pound, that his profit may be equivalent with C's? Ans. 5 cents.

13. A. and B. barter: A. has 160 pounds of tallow, at 10 cents per pound, for which B. gives him $10.00 in ready money, and the rest in candles, at 12½ cents per pound: I desire to know how many pounds of candles B. gives A. beside the money. Ans. 48 pounds.

14. C. and D. barter: C. has 21 pounds of pepper, at 7 cents per pound; D. has ginger, at 10½ cents per pound—How much ginger must he deliver in barter for the pepper? Ans. 14 pounds.

15. A. has 15 C. of cheese, at 10 cents per pound; B. has 7 pieces of muslin, at $2.40 per piece, and 14 pieces of Irish cloth, at $9.00 per piece: I desire to know who must receive the difference, and how much? Ans. A. must receive $7.20.

16. A. has 1000 bushels of lime, at 12 cents per bushel, ready money, which he barters with B. at 15 cents per bushel, taking wheat at $1.30 per bushel, which is worth but $1.00—How many bushels of wheat will pay for the lime? who gets the best bargain? how much on the whole, and what per cent.? Ans. 115 bu. 1 P. 4 qts. + wheat; B. gains $4.4615 on the whole, and 5 per cent.

FELLOWSHIP.

FELLOWSHIP is a rule which enables merchants and others, trading in partnership, to determine each person's particular share of the gain, in proportion to each one's share of the stock and time of its continuance in trade.

By this rule, legacies may be adjusted, when there is a deficiency of assets or effects; as also, a bankrupt's estate may be divided among his creditors.

CASE I.

When the several stocks in company are considered without regard to time, or continue an equal space of time.

RULE 1.

As the whole debt or amount of stock,
Is to any partner's share in stock,
So is the whole gain or loss
To the same partner's share or dividend.

RULE 2.

Find the gain or loss per dollar, by dividing the whole gain or loss by the whole stock;

Then, multiply the gain or loss per dollar, by each partner's stock respectively; and the product is the proportional gain or loss required.

Proof.—Add all the shares together, and the sum will be equal to the given gain or loss; but the surest way is, to say, As the whole gain or loss, is to each partner's share of the gain or loss, so is the whole stock, to his share in stock.

Examples.

1. A. B. and C. join their stocks in trade: the amount of their stock is $3672, and are in proportion as 1, 2 and 3, are to one another; and the amount of their gain is equal to C's stock—What is each man's stock and gain?

1
2
3
—

As 6 : 1 :: 3672 : 612 = A's stock.
6 : 2 :: 3672 : 1224 = B's stock.
6 : 3 :: 3672 : 1836 = C's stock, and whole gain.

As 3672 : 612 :: 1836 : 306 = A's gain.
3672 : 1224 :: 1836 : 612 = B's gain.
3672 : 1836 :: 1836 : 918 = C's gain.

2. Two merchants trade together: A. put into stock $120, and B. $160: they gained $60—What is each person's share thereof? Ans. A's gain, $25.714; B's, $34.286.

3. A. and B. having gained by merchandize $500; A. put in $1274, and B. $726—I demand each of their shares of the profit. Ans. A.'s $318.50; B.'s $181.50.

4. Three butchers pay among them $50 for a grass inclosure, into which they put 200 cows; whereof A. had 50, B. 70, and C. 80—How much had each to pay?

Ans. A. $12.50; B. $17.50; C. $20.00.

5. Three persons, B., C. and D., join in company; B.'s stock was 600 dollars, C.'s 700 dollars, and D.'s 1100 dolls. and they gained 600 dolls.—What is each partner's particular share of the gain?

Ans. B. $150; C. $175; D. $275.

6. A bankrupt is indebted to A. 2000 dollars; to B. 1500 dollars; to C. 2500 dollars, and to D. 3000 dollars; and his effects are found to amount to only 4500 dolls.—I demand what sum each creditor must receive, and how much it will be on the dollar. Ans. A. must receive $1000; B. $750; C. $1250; D. $1500;—on the dollar, 50 cts.

7. A man bequeathed his estate to his three sons, in the following manner, viz. To the eldest, 480 dollars, to the second, 440 dolls. and to the third 360 dolls.; but when his debts were paid, there were but 960 dolls. left—what is each one's share of the estate?

Ans. Eldest, $360; second, $330; third, $270.

8. A., B. and C. freight a ship from Paris for Philadelphia, with 200 tuns of wine, of which A. had 40; B. 100, and C. 60; the mariners, meeting with a storm at sea, were constrained, for the safety of their lives, to cast 50 tuns overboard—I wish to know how many of the 50 tuns each particular merchant has lost, according to the rate of his adventure.

Ans. A. 10; B. 25, and C. 15.

9. A father left his estate of 2400 dolls. among 3 sons, in such manner that for every 3 dolls. that A. gets, B. shall have 4 dolls. and C. 5 dolls.—How is the estate to be divided?

Ans. A.'s share, $600; B.'s, $800; C.'s, $1000.

10. A merchant being deceased, it is found he owes to A. 400 dolls.; to B. 480 dolls., and to C. 520 dolls. though he left but 1200 dolls. behind him—I demand how much each is to have in proportion to his debts.

Ans. A. $342.8571; B. $411.4286; C. $445.7143.

11. A man dying, left an estate worth 6000 dolls. which is to be divided as follows, viz. the widow to have one-third, and the remainder to be divided among 4 sons and 7 daughters; the sons taking two shares to the daughters' one—what sum will each receive? Ans. The widow, $2000; each of the sons, 533.33\frac{1}{3}$; each of the daughters, 266.66\frac{2}{3}$.

CASE II.

When the respective stocks in company continue an unequal space of time.

Rule 1.

Multiply each partner's stock by the time it was in trade; Then, As the sum of the products,

Is to each particular product;

So is the whole gain or loss,

To each partner's share of the gain or loss.

Rule 2.

Find the gain or loss per dollar, by dividing the whole gain or loss by the sum of the products of the stock and time; then multiply the gain or loss per dollar by each product, for each partner's share of the gain or loss.

Examples.

1. Three merchants join in company for 12 months; D. puts in 400 dolls., and at five months' end took out 100 dolls., and at the end of 7 months took out 200 dolls. and at 11 months' end put in 400 dolls.; E. puts in at first 600 dolls., and at the end of 3 months puts in $100 more; at the end of 9 months he took out 500 dolls., but puts in 200 dolls. at the end of 10 months, and withdraws 100 dolls. at the end of 11 months; F. puts in at first 1000 dolls., and at the end of six months took out 500 dolls., at the end of 7 months puts in 100 dolls., but takes out 400 dolls. at the end of 10 months; at the end of 12 months they gained 560 dolls.—I desire to know each man's share of the gain.

D. at first puts in $400 for 12 months, = 400×12 = 4800
He then takes out 100 for 7 months, = 100× 7 = 700

4100
He also takes out 200 for 5 months, = 200× 5 = 1000

3100
He puts in 400 for 1 month, = 400× 1 = 400

D's product, 3500

E. at first puts in 600 for 12 months, = 600×12 = 7200
He also puts in 100 for 9 months, = 100× 9 = 900

8100
He takes out 500 for 3 months, = 500× 3 = 1500

6600
He puts in 200 for 2 months, = 200× 2 = 400

7000
He takes out 100 for 1 month, = 100× 1 = 100

E's product, 6900

F. at first puts in 1000 for 12 mo's, = 1000×12 = 12000
He takes out 500 for 6 mo's, = 500× 6 = 3000

9000
He puts in 100 for 5 mo's, = 100× 5 = 560

9500
He takes out 400 for 2 mo's, = 400× 2 = 800

F's product, 8700

D's product, 3500
E's product, 6900
F's product, 8700

		$	$	$	
As	19100	: 3500	:: 560	: 102.6178	D's share.
"	19100	: 6900	:: 560	: 202.3037	E's share.
"	19100	: 8700	:: 560	: 255.0785	F's share.

2. A. and B. enter into partnership; A. puts in 90 dolls.

for 6 months, and B. 120 dolls. for 4 months, and they gained 85 dolls.—What is each man's share of the gain?

Ans. A's $45; B's $40.

3. A., B. and C. hold a piece of ground in common, for which they are to pay 65 dolls.; A. puts in 40 oxen for 100 days; B. 64 oxen for 120 days, and C. 90 oxen for 80 days—What is each man to pay of said rent?

Ans. A. $13.771; B. $26.441; C. $24.788.

4. B. commenced trade January 1st, with a capital of 800 dolls. and meeting with success in business, took in C. as a partner, with a capital of 1200 dolls. on the first of May following; two months after that, they admit D. as a third partner, who brought sufficient stock in to entitle him to share equal profits the first of the following year with his partners; at which time they found they had gained 600 dolls.—Required D's stock, and each man's share, including his stock and gain. Ans. D's stock, $1600; B's share, $1000; C's, $1400, and D's, $1800.

5. A, and B. enter into partnership; A. puts in 120 dolls. for 9 months, and B. 200 dolls. for 6 months; A's share of the gain was 27 dolls.—What was gained in all? Ans. $57.

EXCHANGE.

By Exchange is meant the giving of the money, weight or measure of one country, for the like value in money, bills, weight or measure of another country.

Par, in Exchange, is a supposed equality between the money of one country and that of another; the course of exchange is frequently above or below par; for bills of exchange are a kind of commodity which rise and fall in price, according as there is greater or less demand for them.

Agio is a term used to signify the difference in some countries between bank and current money.

Exchange may be computed by the legal or intrinsic value of the coins, when remittances are made in cash; but as they are generally made between distant places, by bills of exchange, and most frequently pass for more or less than the intrinsic values of the sums for which they are drawn, the rate of exchange must then be taken into the account.

England.

In England accounts are kept in pounds, shillings, pence and farthings.

The par of exchange between the United States and England, is $4.44 for one pound sterling, or 40 dollars for 9 pounds sterling; therefore, to reduce federal money to sterling, (or English):

Rule.

Multiply the dollars by 9, and divide by 40, for the answer in pounds sterling; or,

As 40 dollars,
Is to the federal money given,
So is 9 pounds
To the sterling required.

Or, multiply the federal money in cents by 27, and divide by 50, for the answer in pence.

To reduce Sterling to Federal Money.

Rule.

Multiply the pounds by 40, and divide by 9, for the answer in dollars; or,

As 9 pounds sterling,
Is to the sterling given,
So is 40 dollars,
To the federal money required.

Or, reduce the sterling money to sixpences, annex two ciphers, and divide by 9, for the answer in cents; or, reduce the sterling money to pence, annex two ciphers, and divide by 54, for the answer in cents.

Examples.

1. I demand the sterling that will discharge a bill of exchange for $800.

$ $ £ £
As 40 : 800 :: 9 : 180 Answer.

2. A. of Philadelphia, drew a bill of exchange upon B. of London, for 1260 pounds sterling—What is the value of this bill in federal money, exchange at par?

£ £ $ $
As 9 : 1260 :: 40 : 5600 Answer.

3. I demand the sterling that will discharge a bill of exchange for $1760, exchange at par. Ans. 396 pounds.

4. B. in New-York, drew a bill of exchange upon a merchant in London, for 531 pounds sterling—How much federal money will discharge the draft, exchange at par?

Ans. $2360.

5. K. of Baltimore, received of R. of London, a quantity of goods, valued in the invoice at 361£. 17s. 4¼d. sterling: required their value in federal money. Ans. $1608.30.+

Note 1.—When the bill of exchange is above par, multiply the sum of the bill by the amount of one pound or dollar, at the given rate per cent.

Note 2.—When the bill of exchange is below par, find one year's interest of the given sum, which must be deducted therefrom; the remainder will be the value required.

6. What is the value of a bill of exchange for $603, at 3 per cent. below par.

$$603 \times .03 = 18.09$$

Then, $603—$18.09 = $584.91 Answer.

7. What is the amount or value of a bill of exchange for $1234, at 5 per cent, above par?

$$1234 \times 1.05 = \$1295.70 \quad \text{Answer.}$$

8. G. in New-York, owes P. in London, 400 pounds sterling, to discharge which, he purchases a bill at 5 per cent. below par—How many dollars must he give for it, and how much will he save by the bill?

Ans. $1688.88⅔ paid, and $88.88⅔ saved.

A TABLE,

Showing the value, in dollars and cents, of the principal foreign coins and currencies throughout the world.

Names of coins.				Value.
France.				
A Livre, tournois,	-	-	-	$0.185
Franc, -	-	-	-	0.1873125
Five franc piece,	-	-	-	0.9365625
Louis d'or,	-	-	-	4.44
Spain.				
A Real plate,	-	-	-	0.10
Real vellon,	-	-	-	0.053125

A Piastre of exchange, -	$0.80
Ducat of exchange, -	1.10
Doubloon of exchange, -	3.20

PORTUGAL.

Silver.

A Crusado of 400 reas, not stamped,	.50
Do. of 480, stamped in 1643, -	.60
Half Crusado, or 12 vintin piece, -	.30
Five Vintin piece, - - -	.125
Two and a half Vintin piece, -	.0625

Gold.

A Double Johannes, - - -	32.00
Single do. - - -	16.00
Half do. - - -	8.00
Quarter do. - - -	4.00
Eighth do. - - -	2.00
Testoon, - - - -	1.00
Moidore, - - - -	6.00
Half Moidore, - - -	3.00
Quarter Moidore, - - -	1.50

HOLLAND.

A Ducatoon, - - -	8.00
Ducat, - - - -	2.00
Pound Flemish, - - -	2.40
Rix Dollar, - - -	1.00
Florin, - - - -	.40
Shilling, - - - -	.12
Stiver, - - - -	.02
Groat, - - - -	.01

HAMBURG.

A Pound Flemish, - - -	2.50
Rix dollar, - - - -	1.00
Shilling Flemish, - - -	.125
Mark Banco, - - -	.333$\frac{1}{3}$
Shilling Lub., - - -	.0208

RUSSIA.

A Ruble, - - - -	.75
Politin, - - - -	.375
Polpolitin, - - - -	.1875

LEGHORN.	
A Geroni,	$1.80
Testoon,	.30
Chevalet,	.04
Lire,	.20
VENICE.	
A Ducat of exchange, (imaginary,)	.9305
CHINA.	
A Tale,	1.48
Mace,	.148
Candareen,	.0148
ALGIERS, TRIPOLI AND TUNIS.	
A Pistole,	3.00
Zequin,	2.25
Chequin,	.75
Rial,	.125
TURKEY.	
A Piaster,	.2614
Para,	.0065
SPANISH WEST INDIES.	
A Peso,	1.00
Real,	.125

A comparison of the American foot, or 12 *inches, with that of other countries.*

	Feet.
Great Britain and its dependencies,	1.
Riga,	1.83
Mantua,	1.5683
Bologna,	1.2037
Venice,	1.1609
Turin,	1.0613
Leyden,	1.0324
Copenhagen,	.9641
Bremen,	.963
Dantzic,	.9433
Frankfort,, (on the Main,)	.948
Amsterdam,	.941
Antwerp,	.9456
France,	.92
Strasburgh,	.919

The conformity of the Weights of the principal trading cities of Europe, with those of the United States.

		Weight of the United States.	
lbs.		lbs.	oz.
100	of Geneva, - - equal to	123	0
100	of Amsterdam, Paris, Bordeaux, -	109	9
100	of Hamburg, - - -	107	5
100	of Antwerp, - - -	103	12
100	of Seville, Cadiz, &c. - -	103	7
100	of Spain, - - - -	97	0
100	of England, Scotland, Ireland, &c.	100	0
100	of Portugal, - - -	95	4
100	of Lyons, (France,) - -	94	3
100	of Toulouse, - - -	92	6
100	of Marseilles, - - -	88	11
100	of Leghorn, - - -	75	8
100	of Genoa, - - -	73	0
100	of Venice, - - -	65	11
100	of Naples, - - -	64	10

A TABLE OF DIFFERENT MONIES,

With explanatory remarks.

France.

12 Deniers - - equal 1 sol.
20 Sols - - " 1 livre.
6 Livres equal (1 ecu, or) 1 crown.

Spain.

There are two sorts of money in Spain; the one is called vellon, and the other, plate money.

The vellon is to the plate money, as 17 to 32.

Accounts are kept in reals and maravedies vellon, by the dealers and commissioners of excise.

Some bankers, merchants and remitters, keep their accounts in old plate, or money of exchange.

Denominations of vellon money.

4	Maravedies vellon		equal	1	quarto.
8½	Quartos or 34 maravedies	vel.	"	1	real vellon.
15	Reals vellon, or 510	do.	"	1	peso or current dollar.
20	Do. do. or 680	do.	"	1	silver or hard dollar.
16	Quartos, or 64	do.	"	1	real plate.

Denominations of plate money.

34 Maravedies of plate, equal 1 real plate.
8 Reals of plate, - " 1 piaster of exchange.
10 Reals of plate, - " 1 dollar.
11 Reals of plate, - " 1 ducat of exchange.
32 Reals of plate, - " 1 doubloon of exchange.

PORTUGAL.

In Portugal, accounts are kept in millreas and reas.

The millrea is an imaginary piece, and is equal to one thousand reas.

For the real monies of Portugal, see table, page 131.

HOLLAND.

In Holland, accounts are kept in guilders, stivers and pennings. The denominations are—

8 Pennings - - equal 1 groat.
2 Groats - - - " 1 stiver.
6 Stivers, or 12 groats " 1 shilling.
20 Stivers - - - " 1 florin or guilder.
2½ Florins, - - " 1 rix dollar.
6 Florins, or 20 shillings, " 1 £ Flemish.
5 Guilders - - " 1 ducat.

HAMBURG AND LUBECK

Keep account in different ways, viz:

Lubish, or of Lubeck.

12 Deniers equal 1 shilling, Lub.
16 Shillings " 1 mark, do.

Flemish, a fictitious currency.

12 Groats or Den. - equal 1 shilling Flemish.
20 Shillings - - " 1 £ do.

---

6 Deniers Lub. - equal 1 groat Flemish.
2 Groats Flemish - " 1 shilling Lub.
6 Shillings Lub. - " 1 shilling Flemish.
120 Shillings do. - " 1 £ do.
1 £ Flemish - - " 2½ Rix dollars.

Their Banco money is better than their current.

The exchange between the United States and Hamburg, is 33⅓ cents per mark banco, or one dollar for every rix dollar of 3 marks banco.

Russia.

In Petersburg, accounts are kept in rubles and copecs.

The denominations are:

3 copecs	-	equal 1	altine.
10 copecs,	-	- 1	grivena.
25 copecs,	-	- 1	polpolitin.
2 polpolitins,	-	- 1	politin.
2 politins,	-	- 1	ruble.
2 rubles,	-	- 1	ducat.

Genoa, Leghorn, Florence and Corsica.

Accounts are kept in St. George's Bank in pezzoes or piastres, soldi and denari.

12 denari	equal 1	soldi.
20 soldi	- 1	pezzo, piastre or dollar.

This is the money of exchange.

Out of the bank, accounts are generally kept in lire, soldi, and denari, divided as before,

The lire or livre of Genoa is only ⅕ value of the exchange money; that of Leghorn is equal in value only ⅓ of the exchange.

12 denari	-	equal 1	soldi.
20 denari,	-	- 1	lire.
4 denari,	-	- 1	chevalet.
30 denari,	-	- 1	testoon.
6 testoons,	-	- 1	geroni.

Venice.

There is a public depository of the merchants' money called the bank of Venice, where bills of exchange and foreign business are done. The funds of the bank were fixed at 5,000,000 ducats.

The denominations are:

5½ soldi	-	equal 1	gross.
24 gross,	-	- 1	ducat.

For the sake of ease in calculation, merchants and bankers keep their accounts in ducats, sols, and deniers d'or.

12 deniers d'or	-	equal	1 sol.
20 sols	- -	-	1 ducat.

This money is imaginary; 100 ducats of which are equal to 120 ducats, current money: the difference is called agio.

China.

In the empire of China they reckon by tales, mace, candareens and caxas. The denominations are:

10 caxas	- -	equal	1 candareen.
10 candareens,	-	-	1 mace.
10 mace,	- -	-	1 tale.

Barbary.

The denominations are:

10 aspers	- equal	1 rial.
2 rials,	- -	1 double.
4 doubles,	- -	1 dollar.
24 medins,	- -	1 chequin.
32 chequins or 80 aspers,		1 dollar.
180 aspers,	- -	1 sequin.
15 doubles or 300 aspers,		1 pistole.

Turkey.

The denominations are:

3 aspers,	- - equal	1 para.
40 paras or 120 aspers,	-	1 piaster.

English West Indies.

Accounts are kept here in pounds, shillings and pence. One pound is equal to 3 dolls. federal money.

Spanish West Indies.

Accounts are kept here in dollars and reals; or in pesos or dollars, reals, and maravedies. Their peso or dollar is equivalent to a dollar, federal money.

34 maravedies	-	equal	1 real.
8 reals,	- -	-	1 peso or dollar.

Rule.

The various operations, in the exchanging of monies, are performed by the single rule of three or practice.

Note—The par of exchange between the United States and other countries may be ascertained by the table, pages 130 to 133.

Examples.

1. A merchant in Paris is indebted to a merchant in Philadelphia 5642 livres, 15 sols, 7 deniers—What is the amount in federal money; exchange at par?

	Livre.		Livres.	Sols.	Den.		$
As	1	:	5642	15	7	::	.185
	20		20				
	20		112855				
	12		12				
	240		1354267				
			.185				
			6771335				
			10834136				
			1354267				
			250539.395				

240)250539.395(1043.914 Answer.
240

1053
960

939
720

2193
2160

339
240

995
960

35

2. Reduce 625 reals, 20 maravedies, vellon, to reals of plate or exchange, also to federal money.

R. M.
As 32 : 625 20 :: 17
34
2520
1875
21270
17
148890
21270
4)361590
32{
8)90397.5
34)11299.6875(332
102
109
102
79
68
11

R. Mar.
11.6875 plate money. Ans.

R. R. Marv. S
As 1 : 332 11.6875 :: 10
34 34
1339
996
S
34)1129.9.6875(33.23437 federal value.
102
109
102
79
68
116
102
148
136
127
102
255
238
17

Note—A more concise way of reducing vellon to plate money, is to reduce the vellon to maravedies, and divide by 64; the quotient will be the reals plate.

Thus,

	R.	M.
	625	20
	34	
	2520	
	1875	
64	8)21270	
	8)2658.75	
	332.34375	
	34	
	137500	
	103125	
	11.6375	

Hence 332 reals 11.6875 maravedies, as before.

3. A. of Lisbon, draws on B. of New York, for 1947 millreas, 400 reas—How much federal money will discharge this bill; exchange at $1.24 per millrea? Ans. $2414.776.

4. What is the value of 47 crusados in federal money?
Ans. $23.50.

5. Reduce 19 moidores to dollars. Ans. $114.

6. A merchant in Rotterdam remits £327, 5 shillings, 10½ groots, Flemish, to be paid in Baltimore—how much federal money will discharge this bill, exchange at par?
Ans. $785.505.

7. A. of New York, receives from B. of Amsterdam, an invoice of goods, amounting to 15120 florins, 12 stivers, 6 pennings—How much federal money must be remitted to discharge the bill, at 40 cents per florin?
Ans. $6048.24½ cts.

To reduce current money to bank,

RULE.

As 100 with the agio added, Is to 100, So is the given sum in current money, To the bank money required.

Examples.

8. What will 988 guilders, current money, amount to in bank money, the agio being at 4 per cent.? Ans. 950.

To reduce bank money to current money.

RULE.

As 100 Is to 100 with the agio added; So is the bank money given, To the current money required.

Examples.

9. What is the amount, in current money, of 1900 guilders, bank money, the agio being at $3\frac{1}{2}$ per cent.? Ans. $1966\frac{1}{2}$.

10. B. in Boston, draws on H. of Hamburg, for 1254 marks banco, 3 shills. 7 deniers; and receives at the rate of one dollar for every three marks—What is the value in federal money? Ans. $418.07\frac{1}{2}$ nearly.

11. In 465 rubles of Russia, how much federal money? Ans. $348.75.

12. In 196 pezzos, 5 soldi, 6 denari, (Genoa,) how much federal money? Ans. $196.27\frac{1}{2}$.

13. Bought a bill of exchange on Venice, amounting to $1212.07—What is the amount in Venetian ducats of exchange, at $.9305 per ducat? Ans. 1302 ducats, 12 sols.+

14. In 674 tales of China, how many dollars, federal money? Ans. $997.52.

15. What sum, in federal money, will pay a bill of 500 chequins at Tunis? Ans. $375.

16. What sum, sterling, will pay a bill in Constantinople, of 3400 piastres? Ans. 199£. 19s. 5d.

17. Sold goods in Jamaica, for 604 pounds, 6 shillings and 8 pence—What is the amount in federal money? Ans. 1813 dolls.

18. A merchant of Vera Cruz exported goods to Philadelphia, which, when disposed of, amounted to $943.20—What is the value thereof in Spanish West India currency? Ans. 943 pesos, 1 rial, 20 mara.

CUSTOM-HOUSE ALLOWANCES.

Allowances are made in the weight of goods, at the custom-houses of the United States, for tare and draft or scalage.—Tare is the weight of the box, barrel, bag, hogshead, cask, &c.

which contains the goods; and is either the real or actual tare, or computed at so much per cent. at so much per box, &c.

Draft or scalage is an allowance of ½ per cent., computed on the whole gross weight of the goods, (tea and sugar excepted.) There is a deduction to be made on sugar, for draft or scalage of 2 pounds on every barrel, 4 pounds on every Havana box, 4 pounds on every tierce, and 7 pounds on every hogshead. No draft is allowed on tea.

Gross weight is the whole weight of the goods, together with that which contains them.

Neat weight is the weight of the goods alone, after all allowances have been deducted.

CASE I.

To find the neat weight of the goods, when the real or actual tare is allowed, with allowance for draft or scalage.

RULE.

When the scalage is ½ per cent. divide the whole gross weight by 200, the quotient will be the scalage.

When the scalage is rated per hogshead, box, &c., multiply the scalage of one by the number of hogsheads, boxes, &c.: the product will be the scalage of the whole.

Add the scalage and tare together, and subtract their sum from the whole gross weight—the remainder will be the neat.

Examples.

1. What is the neat weight and value of 5 casks of raisins, weighing as follows:—No. 1, gross 79 lbs tare 7 lbs.; No. 2, gross 81 lbs. tare 10 lbs.; No. 3, gross 95 lbs. tare 12 lbs.; No. 4. gross 67 lbs. tare 6 lbs.; No. 5, gross 93 lbs. tare 12 lbs—scalage ½ per cent. and price 13 cents per pound?

lbs.		lbs.		lbs.	
79		7		415	
81		10		49	
95		12		—	
67		6		366	Neat ans.
93		12		.13	
—		—		—	
2,00)4,15	Gross.	47	Tare.	1098	
—		2	Scalage.	366	
2 lbs. scalage.		—		—	
		49		$47.58	Value.

2. What is the neat weight and value of 6 boxes of Havana sugar, weighing 200 pounds each; tare, in the whole, 200 pounds; scalage, 4 pounds per box—at 11 cents per pound? Ans. neat 976 lbs.; value $107.36.

3. Sold 4 casks of indigo, weighing, gross, 15 C. 1 qr. 15 lbs.; tare, 40 pounds per cask; scalage, ½ per cent.—What is the neat weight and value at $2.25 per pound?

Ans. neat 13 C. 2 qr. 22.3 lbs.; Value, $3087.67½.

CASE II.

When the tare is at so much per cent. with allowance for draft or scalage.

RULE.

Find the scalage as before, which deduct from the gross weight; multiply the remainder by the tare per cent.; divide the product by 100: this quotient will be the whole tare.

Deduct the tare from what remained after the scalage was deducted, and the remainder will be the neat.

Examples.

1. What is the neat weight of 7 bags of coffee, weighing 840 pounds gross, allowance 3 per cent. for tare, and ½ per cent for scalage? and what is the value of the neat weight, at 17 cents per pound?

lbs.		lbs.		lbs.	
2,00)840		840		866	
		4		25	Tare.
4	Scalage.				
		836		811	Neat.
		3		17	
		25.08	Tare.	5677	
				811	
				$137.87	Ans.

2. What is the neat weight of 9 boxes of Havana sugar, each weighing 400 pounds, allowance 2½ per cent. for tare, scalage 4 pounds per box? and what is the value of the neat weight, at $9.40 per 100 lbs.?

Ans. neat 3475 lbs.; value, $326.65.

3. What is the neat weight and value of 3 boxes of figs, weighing 25 pounds each, with allowance of 4 per cent. tare, and $\frac{1}{2}$ per cent. salvage, at 11 cents per pound?

Ans. neat 71 lbs.; value, $7.81.

CASE III.

When the tare is so much per barrel, box, chest, &c., either with or without the allowance for draft or scalage.

Rule.

If any allowance be made for draft or scalage, cast and deduct it as before directed.

Multiply the number of barrels, boxes, chests, &c., by the tare of one; subtract this product from what remained after the scalage was deducted; but when no scalage is allowed, deduct the tare from the whole gross weight: the remainder will be the neat weight.

Examples.

1. What is the neat weight and value of twenty chests of hyson tea, weighing 1500 pounds gross, tare 24 pounds per chest, at 50 cents per pound?

		lbs.	
20		1500	
24		480	
480	Tare.	1020	Neat.
		50	
		$510.00	Value.

2. What is the neat weight and value of 9 casks of raisins, weighing 720 pounds gross, tare 12 pounds per cask, allowing $\frac{1}{2}$ per cent. scalage, at 6 cents per pound?

Ans. neat 608 lbs.; value, $36.48.

3. What is the neat weight of 5 chests of tea, each weighing gross 75 lbs., tare 5 lbs. per chest? and how much is the value of the neat weight, at 60 cents per pound?

Ans. neat 350 lbs.; value $200.

UNITED STATES DUTIES.

Goods, wares and merchandise, imported into the United States, have duties [illegible]

hundred, gallon, &c. The ad valorem rates of duty are computed by adding 20 per cent. to the actual cost of the goods, if imported from the Cape of Good Hope, or any place beyond it; and 10 per cent. if imported from any other place or country.

Case I.

To find the amount of duty for any amount of goods, wares or merchandize, when the rate per centum ad valorem is given.

Rule.

To the sum reduced to federal money, add 20 per cent., if imported from or beyond the Cape of Good Hope; or 10 per cent. if imported from any other place or country; multiply this amount by the given rate per cent. and divide by 100, for the duty required.

Examples.

1. What is the duty on an invoice of cloth imported from London, which cost 873 pounds sterling, at 40 per cent. ad valorem?

£	£	$
As 9	: 873	:: 40
	40	
	9)34920	
	10)3880	actual cost in federal money.
	388	10 per cent. added.
	4268	
	40	
	$1707.20	duty required.

2. What will be the duty on an invoice of raisins, imported from Spain, which cost 320 piasters, at 30 per cent. ad valorem? Ans. $84.48 cts.

3. What will be the duty on an invoice of silk goods, imported from India, which cost 2000 rupees of 50 cents each, at 20 per cent. ad valorem? Ans. $240.

Case II.

To find the duty on any amount of goods, wares or merchandize, at any given rate per gallon, pound, &c.

RULE.

Multiply the number of gallons, pounds, &c. by the given rate per gallon, pound, &c. and the product will be the duty required.

Examples.

1. What will be the duty on 300 chests of tea, imported direct from China, in a vessel of the United States, weighing gross 22500 lbs. tare 20 lbs. per chest, at 40 cents per pound?

	lb.
300	22500 gross.
20	6000 tare.
6000 lbs. tare.	16500 neat.
	40
	$6600.00 Answer.

2. What will be the duty on 30 pipes of French brandy, containing 3780 gallons, at 50 cents per gallon?

Ans. $1890.

3. What will be the duty on 675 gallons of wine, imported from France, at 48 cents per gallon? Ans. $324.

VULGAR FRACTIONS.

A VULGAR FRACTION is a part or parts of a whole number, and is written thus, $\frac{1}{4}$, one-fourth; $\frac{1}{6}$, one-sixth; $\frac{4}{7}$, four-sevenths.

The figure above the line is called the numerator, and the under figure the denominator, which shows how many parts the integer is divided into; and the numerator shows how many of those parts are meant by the fraction.

There are four sorts of vulgar fractions; proper, improper, compound and mixed, viz.—

1. A proper fraction is when the numerator is less than the denominator, as $\frac{1}{4}$, $\frac{1}{6}$, $\frac{9}{11}$, $\frac{41}{102}$, &c.

2. An improper fraction is when the numerator is equal to or greater than the denominator, as $\frac{4}{3}$, $\frac{5}{4}$, $\frac{12}{7}$, $\frac{151}{2}$, &c.

3. A compound fraction is the fraction of a fraction, and known by the word of; as $\frac{1}{4}$ of $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{4}{7}$ of $\frac{3}{5}$, &c.

4. A mixed number or fraction is composed of a whole number and a fraction; as $1\frac{1}{4}$, $3\frac{2}{3}$, $6\frac{1}{4}$, $12\frac{1}{10}$, $15\frac{16}{17}$, &c.

Note—Any whole number may be made an improper fraction, by drawing a line under it, and putting unity or 1. for a denominator; as 7 may be expressed fraction-wise, thus, $\frac{7}{1}$, and 15 thus, $\frac{15}{1}$, &c.

REDUCTION OF VULGAR FRACTIONS

Is the bringing of them out of one form into another, in order to prepare them for the operation of addition, subtraction, multiplication, division, &c.

Case I.

To reduce a vulgar fraction to its lowest terms.

Rule.

1st. Divide the greater term by the less, till nothing be left; the last divisor will be the common measure, by which divide both terms for the fraction required: Or,

2d, Which is often the shortest way, take the aliquot parts of both terms continually, till in their lowest terms.

Examples.

1. Reduce $\frac{66}{84}$ to its lowest terms.

66)84(1
66
—
18)66(3
54
—
12)18(1
12
—
6)12(2
12

$$6\begin{cases} 66 = 11 \\ \text{—} \quad \text{—} \\ 84 = 14 \end{cases}$$ Answer.

2. Reduce $\frac{94}{100}$ to its lowest terms. Ans. $\frac{47}{50}$.
3. Reduce $\frac{102}{119}$ to its lowest terms. " $\frac{6}{7}$.
4. Reduce $\frac{36}{126}$ to its lowest terms. " $\frac{2}{7}$.
5. Reduce $\frac{120}{160}$ to its lowest terms. " $\frac{3}{4}$.
6. Reduce $\frac{27960}{30000}$ to its lowest terms. " $\frac{233}{250}$.
7. Reduce $\frac{2848}{4272}$ to its lowest terms. " $\frac{2}{3}$.
8. Reduce $\frac{343}{4900}$ to its lowest terms. " $\frac{7}{100}$.

Case II.

To reduce a mixed number to its equivalent improper fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and to the product add the numerator of the fraction, under which write the denominator.

Examples.

1. Reduce $41\frac{12}{17}$ to its equivalent improper fraction.

$$41\tfrac{12}{17}$$
$$47$$
$$299$$
$$164$$
$$1939 \Big\} \text{ The fraction sought.}$$
$$47$$

2. Reduce $4\frac{1}{2}$ to its equivalent improper fraction. Ans. $\frac{9}{2}$.
3. Reduce $12\frac{2}{9}$ to its equivalent improper fraction. " $\frac{110}{9}$.
4. Reduce $19\frac{5}{6}$ to its equivalent improper fraction. " $\frac{119}{6}$.
5. Reduce $41\frac{4}{5}$ to its equivalent improper fraction. " $\frac{209}{5}$.
6. Reduce $75\frac{1}{4}$ to its equivalent improper fraction. " $\frac{301}{4}$.
7. Reduce $10\frac{297}{300}$ to its equivalent improper fraction. " $\frac{3297}{300}$.
8. Reduce $5\frac{43}{50}$ to its equivalent improper fraction. " $\frac{293}{50}$.

CASE III.

To reduce a whole number to an equivalent fraction, that shall have a given denominator.

RULE.

Multiply the whole number by the given denominator; place the said denominator under the product, and it will form the fraction required.

Note.—All fractions represent a division of the numerator by the denominator. Thus, $\frac{12}{4}$ denotes 12 to be divided by 4, and = 3; and $\frac{4}{5}$ denotes 4 to be divided by 5, and = .8.

Examples.

1. Reduce 12 to a fraction whose denominator shall be 5.

$12 \times 5 = 60$, and $\frac{60}{5}$ the answer.

2. Reduce 16 to a fraction whose denominator shall be 7.

Ans. $\frac{112}{7}$.

3. Reduce 19 to a fraction whose denominator shall be 9.

Ans. $\frac{171}{9}$.

4. Reduce 21 to a fraction whose denominator shall be 10.
Ans. $\frac{210}{10}$.
5. Reduce 35 to a fraction whose denominator shall be 6.
Ans. $\frac{210}{6}$.
6. Reduce 14 to a fraction whose denominator shall be 3.
Ans. $\frac{42}{3}$.
7. Reduce 63 to a fraction whose denominator shall be 12.
Ans. $\frac{756}{12}$.
8. Reduce 9 to a fraction whose denominator shall be 41.
Ans. $\frac{369}{41}$.

CASE IV.

To reduce an improper fraction to its equivalent whole, or mixed number.

RULE.

Divide the numerator by the denominator—the quotient will be the whole number; and if there be a remainder, it will be the numerator to the given denominator.

Examples.

1. Reduce $\frac{5184}{163}$ to its equivalent whole, or mixed number.

163)5184(31$\frac{131}{163}$
489
294
163
131
163

2. Reduce $\frac{641}{12}$ to its equivalent whole, or mixed number.
Ans. $53\frac{5}{12}$.
3. Reduce $\frac{209}{40}$ to its proper terms. " $5\frac{9}{40}$.
4. Reduce $\frac{96}{8}$ to its proper terms. " 12.
5. Reduce $\frac{115}{7}$ to its proper terms. " $16\frac{3}{7}$.
6. Reduce $\frac{19}{15}$ to its proper terms. " $1\frac{4}{15}$.
7. Reduce $\frac{91}{12}$ to its proper terms. " $7\frac{7}{12}$.
8. Reduce $\frac{134}{3}$ to its proper terms. " $44\frac{2}{3}$.

CASE V.

To reduce a compound fraction to a single one.

RULE.

Multiply all the numerators together, for a new numerator; and all the denominators, for a new denominator.

If any part of the compound fraction be a whole or mixed number, it must be reduced to an improper fraction.

Like figures in the numerators and denominators may be expunged, and frequently others be contracted by taking their aliquot parts.

Examples.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$, to a single fraction.

$$1 \times 2 \times 3 \times 4 \times 5 = 120 \quad \frac{120}{720} = \frac{1}{6} \text{ Ans.}$$
$$2 \times 3 \times 4 \times 5 \times 6 = 720$$

Or,

$$\frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{3}{4} \text{ of } \frac{4}{5} \text{ of } \frac{5}{6} = \frac{120}{720} = \frac{1}{6}.$$

Or having like figures expunged, thus:

$$\frac{1}{2'} \text{ of } \frac{2'}{3'} \text{ of } \frac{3'}{4'} \text{ of } \frac{4'}{5'} \text{ of } \frac{5'}{6} = \frac{1}{6}$$

2. Reduce $\frac{1}{3}$ of $\frac{1}{2}$ of 7 to a single fraction.

$$\frac{1}{3} \text{ of } \frac{1}{2} \text{ of } \frac{7}{1} = \frac{7}{6} = 1\frac{1}{6}$$

3. Reduce $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{2}{3}$ to a single fraction. Ans. $\frac{1}{4}$.
4. Reduce $\frac{6}{7}$ of $\frac{1}{6}$ of 7 to a single fraction. " $\frac{7}{7}=1$.
5. Reduce $\frac{1}{3}$ of $\frac{8}{9}$ of $\frac{6}{7}$ to a single fraction. " $\frac{16}{63}$.
6. Reduce $\frac{2}{7}$ of $\frac{5}{6}$ of $\frac{7}{9}$ to a single fraction. " $\frac{5}{27}$.
7. Reduce $\frac{8}{11}$ of $\frac{12}{13}$ of $\frac{143}{193}$ to a single fraction. " $\frac{1}{2}$.
8. Reduce $\frac{5}{9}$ of $\frac{6}{13}$ of $\frac{42}{43}$ of $\frac{50310}{63001}$ to a single fraction. $\frac{1}{3}$.

Case VI.

To reduce fractions to a common denominator.

Rule.

Multiply each numerator into all the denominators, except its own, for a new numerator; and all the denominators for a common denominator.

Examples.

1. Reduce $\frac{1}{4}$, $\frac{3}{5}$, $\frac{4}{7}$ and $\frac{5}{6}$ to equivalent fractions, having a common denominator.

$1 \times 5 \times 7 \times 6 = 210$, the new numerator for $\frac{1}{4}$
$3 \times 4 \times 7 \times 6 = 504$, do. $\frac{3}{5}$
$4 \times 4 \times 5 \times 6 = 480$, do. $\frac{4}{7}$
$5 \times 4 \times 5 \times 7 = 700$, do. $\frac{5}{6}$
$4 \times 5 \times 7 \times 6 = 840$, the common denominator.

Therefore the new equivalent fractions are $\frac{210}{840}$, $\frac{504}{840}$, $\frac{480}{840}$ and $\frac{700}{840}$.

2. Reduce $\frac{7}{8}$, $\frac{2}{3}$, $\frac{3}{5}$ and $\frac{5}{7}$, to fractions having a common denominator. Ans. $\frac{735}{840}$, $\frac{560}{840}$, $\frac{504}{840}$ and $\frac{600}{840}$.

3. Reduce $\frac{1}{2}$, $\frac{3}{3}$ and $\frac{12}{17}$, to fractions having a common denominator. Ans. $\frac{51}{102}$, $\frac{68}{102}$ and $\frac{72}{102}$.

4. Reduce $\frac{4}{5}$, $\frac{3}{4}$ and $\frac{9}{10}$, to fractions having a common denominator. Ans. $\frac{160}{200}$, $\frac{150}{200}$ and $\frac{180}{200}$.

5. Reduce $\frac{1}{3}$, $\frac{5}{9}$, $\frac{1}{2}$ and $\frac{3}{5}$, to fractions having a common denominator. Ans. $\frac{180}{540}$, $\frac{300}{540}$, $\frac{135}{540}$ and $\frac{324}{540}$.

Case VII.

To reduce any given fractions to others, which shall have the least common denominator possible.

Rule.

Set down all the denominators in a horizontal line; find a divisor that will divide more than one of them; set down the quotients, and bring into a line with them the numbers which this divisor will not measure. If more than one of these can be divided by any divisor again, proceed as before; and take the continued product of the divisors, and the numbers in this line, which will be the common denominator.

Divide the common denominator by the denominator of each fraction, and multiply the quotient by the numerator of the fraction, and the product will be the numerator of the fraction required.

Examples.

1. Reduce $\frac{2}{3}$, $\frac{4}{5}$, $\frac{1}{6}$ and $\frac{5}{8}$, to fractions having the least possible common denominator.

3)3, 5, 6, 8

2)1, 5, 2, 8

1, 5, 1, 4

$3 \times 2 \times 1 \times 5 \times 1 \times 4 = 120$, the least common denominator.

3)120		5)120	
40		24	
2		4	
80	1st numerator.	96	2d numerator.

6)120	8)120
20	15
1	5
20 3d numerator.	75 4th numerator.

I survey my given numbers, and find 3 will divide two of them, viz: 3 and 6, which I divide by 3, bringing into a line with the quotients the numbers which 3 will not measure. I view the numbers in the second line, and find 2 will measure 2 and 8; and these I divide by 2, and in the third line get 1, 5, 1 and 4. I multiply the numbers in the said line, and the divisors 3 and 2, continually together, for the required common denominator, and find it 120, which I divide by the denominator of each fraction, and multiply the quotients by the numerator of each fraction respectively—and find the equivalent fractions, $\frac{80}{120}$, $\frac{96}{120}$, $\frac{20}{120}$ and $\frac{75}{120}$.

2. Reduce $\frac{11}{24}$, $\frac{3}{4}$, $\frac{13}{36}$, and $\frac{1}{8}$, to fractions having the least common denominator. Ans. $\frac{33}{72}$, $\frac{54}{72}$, $\frac{26}{72}$ and $\frac{9}{72}$.

3. Reduce $\frac{5}{9}$, $\frac{1}{6}$, $\frac{27}{40}$, and $\frac{19}{120}$, to fractions having the least common denominator. Ans. $\frac{200}{360}$, $\frac{60}{360}$, $\frac{243}{360}$ and $\frac{57}{360}$.

4. Reduce $\frac{1}{3}$, $\frac{3}{4}$, $\frac{7}{8}$, and $\frac{5}{12}$, to fractions having the least common denominator. Ans. $\frac{8}{24}$, $\frac{18}{24}$, $\frac{21}{24}$ and $\frac{10}{24}$.

5. Reduce $\frac{1}{7}$, $\frac{1}{8}$, $\frac{1}{16}$ and $\frac{1}{28}$, to fractions having the least common denominator. Ans. $\frac{16}{112}$, $\frac{14}{112}$, $\frac{7}{112}$ and $\frac{4}{112}$.

6. Reduce $\frac{2}{5}$, $\frac{5}{6}$, $\frac{7}{12}$ and $\frac{15}{16}$, to fractions having the least common denominator. Ans. $\frac{96}{240}$, $\frac{200}{240}$, $\frac{140}{240}$ and $\frac{225}{240}$.

7. Reduce $\frac{2}{3}$, $\frac{2}{5}$, $\frac{5}{8}$ and $\frac{9}{10}$, to fractions having the least common denominotor. Ans. $\frac{80}{120}$, $\frac{48}{120}$, $\frac{75}{120}$ and $\frac{108}{120}$.

8. Reduce $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$ and $\frac{1}{81}$, to fractions having the least common denominator. Ans. $\frac{27}{81}$, $\frac{9}{81}$, $\frac{3}{81}$ and $\frac{1}{81}$.

Case VIII.

To reduce fractions of one denomination to the fraction of another, but greater, retaining the same value.

Rule.

Reduce the given fraction to a compound one, by comparing it with all the denominations between it and that denomination which you would reduce it to; then reduce that compound fraction to a single one by case 5th.

Examples.

1. Reduce $\frac{6}{7}$ of a grain to the fraction of a pound troy.

$\frac{6}{7}$ of $\frac{1}{24}$ of $\frac{1}{20}$ of $\frac{1}{12} = \frac{6}{40320} = \frac{1}{6720}$ Answer.

From what has been remarked, it is very easy to conceive $\frac{6}{7}$ of a grain to be $\frac{6}{7}$ of $\frac{1}{24}$ of $\frac{1}{20}$ of $\frac{1}{12}$ of a pound, which reduced to a single fraction, is $\frac{1}{6720}$ of a pound.

2. Reduce $\frac{1}{2}$ of a cent to the fraction of a dollar.

Ans. $\frac{1}{200}$.

3. Reduce $\frac{2}{3}$ of a foot to the fraction of a yard. Ans. $\frac{2}{9}$.

4. Reduce $\frac{1}{2}$ of a yard to the fraction of a perch.

Ans. $\frac{1}{11}$.

5. Reduce $\frac{5}{8}$ of an ounce to the fraction of a pound avoirdupois. Ans. $\frac{5}{128}$.

6. Reduce $\frac{1}{2}$ of a peck to the fraction of a bushel.

Ans. $\frac{1}{8}$.

7. What part of a yard is $\frac{1}{2}$ of an inch? Ans. $\frac{1}{72}$.

8. What part of a day is $\frac{1}{4}$ of an hour? Ans. $\frac{1}{96}$.

CASE IX.

To reduce a fraction of one denomination to the fraction of another, but less, retaining the same value.

RULE.

Multiply the numerator of the given fraction by that number which one of the higher contains of the lower, for a new numerator to the denominator of the given fraction.

Examples.

1. Reduce $\frac{1}{6000}$ of a pound troy to the fraction of a grain.

$\frac{1}{6000} \times \frac{12}{1} \times \frac{20}{1} \times \frac{24}{1} = \frac{5760}{6000} = \frac{24}{25}$ Ans.

2. Reduce $\frac{1}{200}$ of a dollar to the fraction of a cent.

Ans. $\frac{1}{2}$.

3. What part of a foot is $\frac{2}{9}$ of a yard? Ans. $\frac{2}{3}$.

4. What part of a yard is $\frac{1}{11}$ of a perch? Ans. $\frac{1}{2}$.

5. What part of an ounce is $\frac{5}{128}$ of a pound avoirdupois?

Ans. $\frac{5}{8}$.

6. Reduce $\frac{1}{8}$ of a bushel to the fraction of a peck.

Ans. $\frac{1}{2}$.

7. Reduce $\frac{1}{72}$ of a yard to the fraction of a foot.

Ans. $\frac{1}{24}$.

8. Reduce $\frac{1}{96}$ of a day to the fraction of an hour.

Ans. $\frac{1}{4}$.

Case X.

To reduce the value or quantity of a fraction to the known parts of an integer, as of weight, measure, coin, &c.

Rule.

Multiply the numerator by the parts in the next lower denomination, and divide by the denominator; if there be a remainder, multiply it by the next lower denomination, and divide by the denominator as before, and so on, as far as necessary; place the quotients after each other in their regular order, for the required answer.

In examples of federal money it is only necessary to annex ciphers to the numerator, and divide by the denominator.

Examples.

1. What is the value of $\frac{1}{7}$ of a mile?

$$1 \times 8 = 8$$

And 7)8

1 fur. 5 per. 3 yds. 2 ft. $9\frac{3}{7}$ in. Answer.

2. What is the value of $\frac{2}{3}$ of a pound? Ans. 13s. 4d.
3. What is the value of $\frac{6}{7}$ of a yard? Ans. 2 ft. $6\frac{6}{7}$ in.
4. Reduce $\frac{2}{3}$ of a pound troy to its proper value. Ans. 8 oz.
5. Reduce $\frac{6}{7}$ of a yard to its proper value. Ans. 3 qr. $1\frac{5}{7}$ na.
6. Reduce $\frac{5}{8}$ of an acre to its proper value. Ans. 2 R. 20 P.
7. What is the value of $\frac{1}{8}$ of a dollar? Ans. 12 cts. 5 mills.
8. What is the value of $\frac{1}{4}$ of a dollar? Ans. 25 cts.
9. What is the value of $\frac{1}{5}$ of a dollar? Ans. 20 cts.
10. Reduce $\frac{1}{3}$ of a dollar to its proper value. Ans. $33\frac{1}{3}$ cts.
11. What is the value of $\frac{1}{9}$ of a dollar? Ans. $11\frac{1}{9}$ cts.
12. What is the value of $\frac{4}{7}$ of a dollar? Ans. $57\frac{1}{7}$ cts.
13. What is the value of $\frac{2}{3}\frac{1}{2}$ of a dollar? Ans. $65\frac{5}{8}$ cts.
14. Reduce $\frac{1}{2}\frac{9}{0}$ of a dollar to its proper value. Ans. 95 cts.
15. What is the value of $\frac{5}{8}$ of a moidore? Ans. 5 dolls.
16. What is the value of $\frac{1}{3}$ of an eagle? Ans. $\$3.33\frac{1}{3}$.
17. What is the value of $\frac{3}{1}\frac{}{5}$ of a day? Ans. 4 h. 48 min.

18. Reduce $\frac{1}{5}$ of a year to its proper value.
Ans. 73 d. 1 h. 12 min.
19. What is the value of $\frac{3}{4}$ of 3 days? Ans. 2 d. 6 h.
20. What is the value of $\frac{1}{4}$ of a ton? Ans. 5 C.

CASE XI.

To reduce any given value, or quantity, to the fraction of any greater denomination of the same kind.

RULE.

Reduce the given quantity to its lowest term mentioned, for a numerator, then reduce the whole number into the same name for a denominator; this fraction, reduced to its lowest terms, will be the fraction required.

Note—If a fraction be given, multiply both parts by the denominator thereof, and to the numerator add the numerator of the given fraction.

Examples.

1. Reduce 1 fur. 5 p. 3 yds. 2 ft. $9\frac{3}{7}$ in. to the fraction of a mile.

Fur.	P.	yds.	ft.	in.	Mile.
1	5	3	2	$9\frac{3}{7}$	1
40					8
45					8
$5\frac{1}{2}$					40
228					320
$22\frac{1}{2}$					$5\frac{1}{2}$
$250\frac{1}{2}$					1600
3					160
$753\frac{1}{2}$					1760
12					3
9051					5280
7					12
63360 numerator.					63360
					7
					443520 denominator.

$63360)\frac{63360}{443520} = \frac{1}{7}$ Answer.

2. Reduce 13s. 4d. to the fraction of a pound. Ans. $\frac{2}{3}$.
3. Reduce 2 ft. $6\frac{6}{7}$ in. to the fraction of a yard. Ans. $\frac{6}{7}$.
4. Reduce 8 ounces to the fraction of a pound Troy. Ans. $\frac{2}{3}$.
5. Reduce 3 qrs. $1\frac{5}{7}$ na. to the fraction of a yard. Ans. $\frac{6}{7}$.
6. Reduce 2 R. 20 perches, to the fraction of an acre. Ans. $\frac{5}{8}$.
7. Reduce 12 cts. 5 mills to the fraction of a dollar. Ans. $\frac{1}{8}$.
8. Reduce 20 cts. to the fraction of a dollar. Ans. $\frac{1}{5}$.
9. Reduce 30 cts. to the fraction of a dollar. Ans. $\frac{3}{10}$.
10. Reduce $33\frac{1}{3}$ cts. to the fraction of a dollar. Ans. $\frac{1}{3}$.
11. Reduce $11\frac{1}{9}$ cts. to the fraction of a dollar. Ans. $\frac{1}{9}$.
12. Reduce $57\frac{1}{7}$ cts. to the fraction of a dollar. Ans. $\frac{4}{7}$.
13. What part of a dollar is $65\frac{5}{8}$ cents? Ans. $\frac{21}{32}$.
14. What part of a dollar is 95 cents? Ans. $\frac{19}{20}$.
15. What part of a moidore is 5 dollars? Ans. $\frac{5}{6}$.
16. What part of an eagle is $3.33\frac{1}{3}$? Ans, $\frac{1}{3}$.
17. What part of a day is 4 H. 48 min.? Ans. $\frac{1}{5}$.
18. What part of a year is 73 D. 1 H. 12 min.? Ans. $\frac{1}{5}$.
19. What part of a ton is 5 hundred? Ans. $\frac{1}{4}$.

ADDITION OF VULGAR FRACTIONS.

Rule.

Prepare the fractions, by reducing the compound ones to single; the mixed numbers to improper fractions: then reduce each of the fractions to a common denominator; add the numerators together, and place the sum over the common denominator. If it be an improper fraction, reduce it to its equivalent whole or mixed number: if there be any whole numbers, they may be added to the sum of the fractions.

Examples.

1. Add $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{5}{6}$ of $\frac{9}{10}$, $7\frac{3}{5}$, $\frac{3}{4}$ and 5 together.

$\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{5}{6}$ of $\frac{9}{10} = \frac{90}{360} = \frac{1}{4}$, value of the compound frac.

$7\frac{3}{5} = \frac{38}{5}$, The mixed number reduced to an improper fraction.

Then, $\frac{1}{4}$, $\frac{2}{3}$ and $\frac{3}{4}$, the given fractions, prepared.

$1 \times 3 \times 4 = 12$ = the numerator for $\frac{1}{4}$.
$23 \times 4 \times 4 = 368$ = the numerator for $\frac{2}{3}$.
$3 \times 4 \times 3 = 36$ = the numerator for $\frac{3}{4}$.

416 = the sum of the numerator.

$4 \times 3 \times 4 = 48$ = the common denominator.

$48)416(8\frac{2}{3}$ sum of the fractional part.
384

32 2
— = —
48 3

And $8\frac{2}{3}$
5 = the whole number.

$13\frac{2}{3}$ Sum. Answer.

2. Add $\frac{5}{7}$, $\frac{5}{9}$ and $\frac{3}{5}$, together. Ans. $2\frac{5}{6}\frac{5}{3}$.
3. Add $\frac{1}{4}$, $\frac{1}{3}$ and $\frac{5}{12}$, together. " 1.
4. Add, 6, 4 and $\frac{1}{2}$ of $\frac{2}{3}$, together. " $10\frac{1}{3}$.
5. Add $5\frac{1}{2}$, $4\frac{1}{4}$ and $3\frac{1}{3}$, together. " $13\frac{3}{12}$.
6. Add $16\frac{1}{3}$, $\frac{1}{3}$ of $\frac{5}{6}$ and $7\frac{7}{18}$, together. " 24.
7. Add $4\frac{2}{3}$, $5\frac{1}{4}$ and $2\frac{1}{6}$, together. " $11\frac{29}{36}$.
8. Add $\frac{1}{4}$ of a week to $\frac{3}{4}$ of a day. Ans. 2 D. 12 H.
9. Add $\frac{1}{2}$ of a dollar to $\frac{1}{2}$ of a dollar. Ans. 70 cts.
10. Add $\frac{1}{2}$ of a pound Troy to $\frac{1}{2}$ of an ounce.
Ans. 6 oz. 10 dwts.
11. Add $\frac{1}{2}$ of a yard to $\frac{1}{2}$ of a foot. Ans. 2 feet.
12. Add $\frac{2}{3}$ of a day, $\frac{3}{4}$ of an hour and 48 minutes, together.
Ans. 11 H. 9 min.
13. Add $\frac{1}{16}$ of a bushel, $\frac{1}{2}$ of a peck and 26 quarts, together. Ans. 1 bushel.
14. Add $\frac{1}{3}$ of a yard, $\frac{3}{8}$ of a foot and $\frac{7}{16}$ of a mile, together.
Ans. 770 yds. 1 ft. $4\frac{1}{2}$ inches.
15. Add $\frac{2}{3}$ of a week, $\frac{1}{2}$ of a day and $\frac{1}{2}$ an hour, together.
Ans. 5 D. $4\frac{1}{2}$ H.
16. Add $\frac{2}{3}$ of a mile to $\frac{2}{3}$ of a yard. Ans. 1174 yards.
17. If a merchant own $\frac{3}{10}$ of a ship, valued at 5000 dollars, and buys another person's share of her, which is $\frac{2}{7}\frac{1}{0}$, what part belongs to him, and what is it worth?
Ans. $\frac{3}{7}\frac{1}{0}$, worth 4200 dollars.

18. Add $\frac{1}{10}$ of an eagle to $\frac{1}{2}$ of a dollar. Ans. 1 dollar.

19. What is the sum of $\frac{1}{2}$ of four dollars, $\frac{1}{4}$ of two dollars and $\frac{8}{9}$ of one dollar? Ans. 2 dolls.

20. Add $\frac{1}{2}$ of 3 pecks to $\frac{2}{3}$ of 2 bushels.

Ans. 1 bu. 2 P. $6\frac{2}{3}$ qts.

21. What is the sum of $\frac{2}{3}$ of a moidore, $\frac{2}{5}$ of an eagle and $\frac{1}{4}$ of a dollar? Ans. $8.25.

22. What is the sum of $\frac{1}{3}$ of a dollar and $\frac{1}{5}$ of a moidore?

Ans. 1 dollar.

23. What is the sum of $\frac{1}{2}$ of a day, $\frac{3}{4}$ of an hour and $\frac{1}{3}$ of a week? Ans. 2 D. 20 H. 45 M.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Prepare the fractions as in addition; subtract the numerator of the less from the numerator of the greater; place the common denominator under this difference—so is this new fraction the difference of the given fractions.

In subtracting mixed numbers, reduce the fractional parts only to a common denominator; place the less quantity under the greater, and the difference of the numerators will be a numerator to be placed over the common denominator—and the difference of the whole numbers will be a whole number; but if the numerator of the fraction in the lower quantity be greater than the numerator of the fraction in the upper quantity, then take the lower numerator from its denominator, and add the numerator of the fraction in the upper quantity to the remainder; set it down and carry one to the integer of the lower number.

Examples.

1. From 9 $\frac{5}{14}$ take $6\frac{17}{22}$.

2)14 22

7 11 And $2 \times 7 \times 11 = 154$, common multiple.

And $154 \div 14 \times 5 = 55$

$154 \div 22 \times 17 = 119$

$9\frac{55}{154}$

$6\frac{119}{154}$

$2\frac{90}{154} = 2\frac{45}{77}$ Answer.

2. From $6\frac{2}{3}$ take $4\frac{1}{4}$. Ans. $2\frac{1}{6}$.
3. From $14\frac{1}{2}$ take $12\frac{7}{8}$. " $1\frac{3}{16}$.
4. From $\frac{1}{3}$ subtract $\frac{1}{4}$. " $\frac{1}{12}$.
5. From 19 take $\frac{1}{3}$ of 17. " $13\frac{1}{3}$.
6. From 75 take $47\frac{1}{3}$. " $27\frac{2}{3}$.
7. From $\frac{5}{6}$ of $\frac{3}{14}$ subtract $\frac{2}{7}$ of $\frac{3}{7}$. " $\frac{3}{49}$.
8. From $\frac{1}{2}$ a dollar take $\frac{1}{4}$ of a cent. Ans. $49\frac{3}{4}$ cts.
9. From $\frac{1}{4}$ of a mile take $\frac{1}{15}$ of a league. Ans. 88 yds.
10. From $\frac{6}{7}$ of a week take $\frac{20}{3461}$ of a year. Ans. 1 day.
11. From $\frac{1}{15}$ of a day take $\frac{3}{4}$ of an hour. Ans. 51 min.
12. From 4 weeks take $21\frac{1}{3}$ days. Ans. $6\frac{4}{7}$ days.
13. From $\frac{1}{4}$ of a yard take $\frac{1}{2}$ of a foot. Ans. 3 inches.
14. From $\frac{1}{2}$ an eagle take $\frac{1}{2}$ a dollar. Ans. $4.50.
15. From $\frac{1}{4}$ of a pound Troy take 2 ounces. Ans. 1 oz.
16. From $\frac{1}{3}$ a bushel take $\frac{1}{2}$ a peck. Ans. 12 quarts.
17. From $\frac{6}{15}$ of an hour take $\frac{1}{5}$ of an hour. Ans. 12 min.
18. From $\frac{1}{2}$ an acre take $\frac{1}{4}$ of a rood. Ans. 1 R. 30 P.
19. Borrowed 40 dollars, paid $\frac{1}{5}$ of 110 dollars—What remains? Ans. 18 dollars.
19. Take $\frac{1}{4}$ a moidore from $\frac{1}{2}$ an eagle. Ans. 2 dolls.

MULTIPLICATION OF VULGAR FRACTIONS.

Rule.

If a mixed number be given, reduce it to an improper fraction, or if a whole number, put it to a fractional form, by writing 1 for the denominator. Compound fractions, in the operation, may retain their original form.

Multiply the numerators together for a new numerator, and the denominators for a new denominator—which reduce to their proper terms for the answer required.

Where several fractions are to be multiplied, if the numerator of one fraction be equal to the denominator of another, their equal numerators and denominators may be omitted.

Examples.

1. Multiply $\frac{1}{4}$ of $\frac{3}{5}$ of $\frac{4}{7}$ by $\frac{1}{2}$ of $6\frac{2}{3}$.

$$6\frac{2}{3} = \frac{20}{3}$$

Then, $\frac{1}{4}$ of $\frac{3}{5}$ of $\frac{4}{7} \times \frac{1}{2}$ of $\frac{20}{3} = \frac{20}{70} = \frac{2}{7}$ Ans.

2. Multiply $\frac{7}{10}$ of $\frac{4}{7}$ by $\frac{1}{3}$ of $\frac{11}{12}$. Ans. $\frac{77}{420}$.

3. Multiply $3\frac{1}{2}$ by $\frac{1}{6}$. Ans. $\frac{7}{12}$.
4. Multiply $62\frac{1}{2}$ by $\frac{1}{15}$. " $4\frac{1}{6}$.
5. Multiply $6\frac{1}{4}$ by $5\frac{3}{8}$. " $33\frac{19}{32}$.
6. What is the product of $\frac{2}{5}$ of 9, multiplied by $\frac{1}{3}$ of $1\frac{2}{3}$? Ans. 2.
7. What is the continued product of $\frac{2}{3}$, $1\frac{1}{4}$, $\frac{1}{6}$, $3\frac{1}{3}$ and 12. Ans. $5\frac{5}{6}$.
8. Multiply $7\frac{1}{2}$ by $\frac{1}{3}$ of $\frac{2}{3}$. Ans. $2\frac{1}{2}$.
9. Multiply $6\frac{1}{4}$ by $\frac{1}{4}$ of 6. Ans. $9\frac{3}{8}$.
10. Multiply 100 by $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{8}{9}$ of $\frac{9}{10}$. Ans. 10.
11. What is the continued product of $3\frac{1}{3}$, $2\frac{1}{3}$, $\frac{1}{3}$, $\frac{7}{8}$ and $1\frac{1}{9}$? Ans. $2\frac{25}{48}\frac{3}{6}$.
12. Multiply $6\frac{7}{8}$ by $2\frac{2}{3}$. Ans. $18\frac{1}{3}$.
13. Multiply 41 by $\frac{2}{3}$ of 4. Ans. $109\frac{1}{3}$.

DIVISION OF VULGAR FRACTIONS.

Rule.

Prepare the fractions, if necessary, as in multiplication; then multiply the denominator of the divisor by the numerator of the dividend for a numerator; and the numerator of the divisor by the denominator of the dividend for a denominator.

Examples.

1. Divide $\frac{1}{9}$ by $6\frac{2}{3}$.

$6\frac{2}{3} = \frac{20}{3}$ $\quad \frac{20}{3})\frac{1}{9}(\frac{3}{180} = \frac{1}{60}$ Answer.

2. Divide $\frac{1}{2}$ of $\frac{3}{5}$ by $\frac{1}{3}$ of $\frac{5}{6}$.

$\frac{1}{3}$ of $\frac{5}{6})\frac{1}{2}$ of $\frac{3}{5}(\frac{5}{30} \frac{4}{} = 1\frac{2}{5}$ Answer.

Or, by reducing the compound fractions to single ones,

Thus, $\frac{1}{3}$ of $\frac{5}{6} = \frac{5}{18}$

$\frac{1}{2}$ of $\frac{3}{5} = \frac{3}{10}$ $\quad \frac{5}{18})\frac{3}{10}(\frac{5}{8} \frac{4}{0} = 1\frac{2}{5}$ as before.

3. Divide 4 by $\frac{1}{4}$. Ans. 16.
4. Divide $27\frac{1}{2}$ by $\frac{1}{2}$ of 27. Ans. $2\frac{1}{27}$.
5. Divide $\frac{3}{4}$ by $\frac{1}{2}$. Ans. $1\frac{1}{2}$.
6. Divide $9\frac{1}{4}$ by 6. Ans. $1\frac{13}{24}$.
7. Divide $4\frac{1}{6}$ by $\frac{1}{6}$ of 4. Ans. $6\frac{1}{4}$.
8. Divide $\frac{1}{6}$ of 4 by $4\frac{1}{6}$. Ans. $\frac{4}{25}$.
9. Divide $\frac{7}{11}$ by $\frac{3}{11}$. Ans. $2\frac{1}{3}$.

10. Divide $\frac{7}{8}$ of 6 by $\frac{3}{4}$ of $\frac{6}{7}$ of $8\frac{1}{2}$. Ans. 1.
11. Divide $6\frac{2}{3}$ by $6\frac{1}{3}$. Ans. $1\frac{1}{19}$.
12. Divide $620\frac{1}{3}$ by $206\frac{2}{3}$. Ans. 3.

Note.—When the denominator of the divisor and of the dividend are equal, the quotient may be found by common division, viz. by dividing the numerator of the dividend by the numerator of the divisor: or this rule may be rendered more general, by reducing the fraction to a common denominator, and dividing as before, rejecting the common denominator entirely.

As, if $\frac{1}{2}$ were to be divided by $\frac{1}{4}$; $\frac{1}{2}$ is equal to $\frac{2}{4}$, and 2 divided by 1 is 2, the quotient required.

13. Divide $\frac{3}{7}$ by $\frac{2}{7}$.
$\frac{3}{7}$ and $\frac{2}{7}$ reduced to a common denominator, is $\frac{15}{35}$ and $\frac{14}{35}$. and $15 \div 14 = 1\frac{1}{14}$ Answer.
14. Divide $\frac{6}{7}$ by $\frac{3}{7}$. Ans. 2.
15. Divide $\frac{15}{17}$ by $\frac{3}{17}$. Ans. 5.
16. Divide $\frac{5}{9}$ by $\frac{7}{9}$. Ans. $\frac{5}{7}$.
17. Divide $\frac{11}{13}$ by $\frac{6}{11}$. Ans. $1\frac{31}{66}$.

THE SINGLE RULE OF THREE IN VULGAR FRACTIONS.

Rule.

Prepare the given terms, if necessary, by reduction, and state them as in whole numbers; multiply the second and third terms together, and divide that product by the first term: Or,

Multiply the denominator of the first and the numerators of the second and third terms continually together, for a numerator; and the numerator of the first, and denominators of the second and third terms for a denominator.

Examples.

1. If $5\frac{1}{3}$ pounds of butter cost $63\frac{1}{8}$ cents, what cost $2\frac{1}{7}$ pounds?

$5\frac{1}{3} = \frac{16}{3}$ $\quad 63\frac{1}{8} = \frac{505}{8}$ $\quad 2\frac{1}{7} = \frac{15}{7}$

lb. lb. cts.

As $\frac{16}{3} : \frac{15}{7} :: \frac{505}{8} : \frac{23735}{336} = 25\frac{335}{336}$ cts. Answer.

2. If $\frac{9}{10}$ lb. of sugar cost 9 cts. what cost $15\frac{1}{4}$ lbs.?
Ans. $\$1.52\frac{1}{2}$.

3. When 2 ounces of silver cost $\$1.94\frac{3}{4}$, what is the value of $\frac{1}{3}$ of an ounce? Ans. $32\frac{11}{24}$ cts.

4. Sold $48\frac{1}{3}$ bushels of corn for $\$23.20$—How much was it per bushel? Ans. 48 cts.

5. What will $9\frac{1}{4}$ pounds of tobacco come to, when $3\frac{1}{3}$ pounds sell for $63\frac{1}{3}$ cents? Ans. $\$1.75\frac{3}{4}$.

6. Bought $5\frac{7}{9}$ yards of silk, at the rate of 7 yards for 6 dollars—How much does it amount to? Ans. $\$4.95\frac{5}{21}$.

7. What will $7\frac{1}{4}$ pounds of bees-wax come to, at $27\frac{17}{29}$ cts. per pound? Ans. $\$2.00$.

8. If 16 men finish a piece of work in $28\frac{1}{3}$ days, the time is required in which 12 men should do it. Ans. $37\frac{7}{9}$ days.

9. What quantity of stuff that is $\frac{3}{4}$ yd. wide, will line $7\frac{1}{2}$ yards of cloth, $1\frac{1}{2}$ yards wide? Ans. 15 yards.

10. How many yards of cloth, at 6 dollars per yard, must be given for $22\frac{1}{2}$ yards, at $4\frac{1}{2}$ dollars per yard. Ans. $16\frac{7}{8}$ yds.

11. A. lends to B. $12\frac{1}{4}$ dollars for $3\frac{1}{3}$ months—What sum should B. lend to A. for $\frac{1}{2}$ month, to requite his kindness?
Ans. $81\frac{2}{3}$ dollars.

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

Rule.

Prepare the terms, when necessary; then state and work them agreeably to the directions given in whole numbers: or invert the dividing terms, and multiply the upper figures continually for the numerator, and those below for the denominator, of the fractional answer.

Examples.

1. Two brothers at school compute the expenses of their boarding, tuition, &c. for $\frac{2}{5}$ of a year to be $80\frac{4}{5}$ dollars—How much will the education of 3 sons for $2\frac{1}{4}$ years cost their father at that rate?

$$\text{If } \left.\begin{matrix} \frac{2}{1}\text{ s.} & \frac{3}{1}\text{ s.} \\ \frac{2}{5}\text{ yr.} & \frac{9}{4}\text{ yr.} \end{matrix}\right\} \frac{404}{5}$$

$$\frac{1}{2}\times\frac{5}{2}\times\frac{3}{1}\times\frac{9}{4}\times\frac{404}{5} = \frac{54540}{80} = 681\frac{3}{4} \text{ dolls. Answer.}$$

2. If a footman perform a journey of 294 miles in $9\frac{1}{5}$ days of $12\frac{1}{2}$ hours long—How long will it take him to travel $76\frac{2}{3}$ miles when the days are $10\frac{2}{3}$ hours long?

Ans. 2 D. 9 H. $46\frac{2}{3}$ M.

3. When 12 persons use $1\frac{1}{8}$ pounds of tea per month, how much should a family of 8 persons provide for a year?

Ans. 9 lbs.

4. If 5 persons drink $7\frac{4}{7}$ gallons of beer in a week, what quantity will serve 8 persons $22\frac{1}{2}$ weeks? Ans. $280\frac{4}{7}$ gals.

5. If 70 dollars in $\frac{1}{3}$ of a year gain $1\frac{2}{5}$ dollars interest, in what time will $100\frac{1}{2}$ dollars gain $6\frac{3}{100}$ dollars?

Ans. 12 months.

CONTRACTED MULTIPLICATION OF DECIMALS.

RULE.

Place the units place of the multiplier under that place of the multiplicand that is intended to be kept in the product; then invert the order of all the other figures, that is, write them all the contrary way; then in multiplying, begin at the figure in the multiplicand, which stands over the figure you are then multiplying with, and set down the first figure of each particular product directly one under the other, and have a due regard to the increase arising from the figures on the right hand of that figure you begin to multiply at in the multiplicand.

Note—That in multiplying, the figure left out every time next the right hand in the multiplicand, if the product be 5 or upwards, to 15, carry 1: if 15, or upwards, to 25, carry 2: and if 25, or upwards, to 35, carry 3, &c.

Examples.

1. Multiply 296.14364 by 12.71584, and let there be only 4 places of decimals in the product.

296.14364
48517.21

29614364
5922873
2073005
29614
14807
2369
118

3765.7150

2. Multiply 743.56815 by 52.647, and let there be only 3 places of decimals in the product. Ans. 39146.632.

3. Multiply 17.14 by 62.197, reserving only the integers in the product. Ans. 1066.

4. Multiply .7164 by 12.1, reserving 3 places of decimals in the product. Ans. 8.668.

5. Multiply 1.0034 by 799.99, reserving only 2 places of decimals in the product. Ans. 802.72.

CONTRACTED DIVISION OF DECIMALS.

RULE.

Find what place of integers or decimals the first figure of the quotient will possess, and consider how many quotient figures will serve the present purpose; then take the same number of the left hand of the divisor, and as many of the dividend as will contain them, (less than ten times,) rejecting the rest; then, instead of bringing figures down from the dividend, separate one from the right of the divisor as often as necessary, till the whole be exhausted, remembering to carry from the right hand figures of the divisor, as in contracted multiplication.

When there are not so many figures in the divisor, divide as usual, till there be as many of the quotient figures found as the divisor is short of the intended quotient; then use the contraction.

Examples.

1. Divide 642.27541 by 8.671265, and let there be only four places of decimals in the quotient.

3.671265)642.27541(174.9466 Ans.
3671265

2751489
2569886

181603
146851

34752
33041

1711
1468

243
220

23
22

1

2. Divide 2508.928065051 by 184.8207, so as to have 4 places of decimals in the quotient. Ans. 13.5749.

3. Divide 43.538163 by 4.6827035, and let there be 7 places of decimals in the quotient. Ans. 9.2976552.

4. Divide 1254.46403 by 46.205175, and let there be 4 places of decimals in the quotient. Ans. 27.1498.

5. Divide 3765.715 by 296.14364, and let there be 5 places of decimals in the quotient. Ans. 12.71584.

6. Divide 39146.632 by 743.56815, and let there be three places of decimals in the quotient. Ans. 52.647.

CONTRACTED DIVISION.

The following contracted method of dividing, being taken notice of in few works that I have seen, I have chosen to deliver it by itself.

RULE.

Set down the sum after the usual manner; find the first quotient figure, and multiply the divisor as usual, but instead of setting down the product, subtract the product of each re-

spective figure, from the figure above, borrowing as many as necessary, which must be carried to the product of the next figure; bring down the figures as necessary for a dividual, and thus proceed to the end.

Examples.

1. Divide 59143684 by 627812.

627812)59143684(94 quotient.
2640604
129356 remainder.

Explanation.—I find the first quotient figure is 9, and say 9 times 2 are 18, take 18 from 18 and 0 is left; I set this down under the 8, and carry 1; then 9 times 1 are 9, and 1 that I carry make 10; take 10 from 16 and 6 are left; I set this down, and carry 1; then I say 9 times 8 are 72, and 1 that I carry make 73; take 73 from 73, and 0 is left; then 9 times 7 are 63, and 7 that I carry make 70; take 70 from 74, and 4 are left; then 9 times 2 are 18, and 7 that I carry are 25; take 25 from 31, and 6 are left; then 9 times 6 are 54, and 3 that I carry are 57; take 57 from 59 and 2 are left; I then bring down the next figure (4) for a new dividual, and proceed in every respect as before.

2. Divide 7854 by 67.

67)7854(117 quotient.
115
484
15 remainder.

3. Divide 61427 by 121.

121)61427(507 quotient.
927
80 remainder.

4. Divide 7157264 by 23144.

23144)7157264(309 quotient.
214064
5768 remainder.

5. Divide 96215496 by 514217.

514217)96215496(187 quotient.
4479379
3656436
56917 remainder.

6. Divide 623917842 by 7219543.

7219543)623917842(86 quotient.
46354402
3037144 remainder.

7. Divide 543 by 17. Quotient 31; rem. 16.
8. Divide 7259 by 72. Quotient 100; rem. 59.

EQUATION OF PAYMENTS.

CASE I.

To find the equated time for the payment of a sum of money due at several different times.

Rule 1. Find the present worth of each payment, for its respective time; add all the present worths together, and deduct the sum from the sum of the payments; then divide this remainder by the product of the sum of the present worths and the ratio: the quotient will be the true equated time.

Rule 2. Multiply each several payment by the time it has to run: then divide the sum of the products by the sum of the payments; the quotient will be the equated time, nearly.

Examples.

1. A. owes B. $1800, whereof $200 is to be paid at 6 months, $400 at 9 months, and $1200 at 20 months—At what time may the whole debt be paid together, rebate being made at 6 per cent.?

$		$		$		
As 103	:	200	:: 100 :	194.174	present worth of the first payment.
104.50	:	400	:: 100 :	382.775	" 2d paym't.
110	:	1200	:: 100 :	1090.909	" 3d paym't.
$				1667.858	sum of present worths.
1800.000	sum of the payments.				
1667.858	sum of the present worths.				
132.142	discount.				
				1667.858	sum of the present worths.
				.06	ratio.
				100.07148	divisor.

		Years.
100.07148)132.14200	(	1.32047
10007148		12
32070520		3.84564
30021444		30
20490760		25.36920
20014296		True answer,
47646400		15 M. 25 da.
40028592		
76178080		
70050036		
6128044		

By rule 2.

200× 6 = 1200
400× 9 = 3600
1200×20 = 24000
1800) 28800(16 months. Answer, nearly.
1800
10800
10800

Note.—Rule 2 is more compendious than rule 1, but cannot be depended upon as sufficiently accurate.

2. D. owes E. $1200, which is to be paid as follows, viz. $200 down; $500 at the end of 10 months, and the rest at the end of 20 months; but they agreeing to have an equal payment of the whole, the true equated time is required, rebate at 6 per cent.

Ans. By rule 1, 12 mo. 7½ days.
By rule 2, 12½ months.

3. A merchant has owing to him $400 to be paid as follows, viz. $100 at 3 months, $100 at 4 months, and the rest at 8 months; but it is agreed to make one payment of the whole—When will that time be, rebate at 6 per cent.?

Ans. By rule 1, 5 mo. 21 da.+
By rule 2, 5¾ months.

4. G. owes H. $800, of which $500 are to be paid present, and the rest at 8 months; but they agree to make one payment of the whole, and wish to know the time, rebate at 6 per cent.?

Ans. By rule 1, 2 mo. 28 da.
By rule 2, 3 months.

CASE II.

When a sum of money is to be apportioned among several, in such a manner that each one's share, placed at interest for unequal terms, shall produce equal amounts.

Rule.

Find the amount of $100, at the given rate per cent. for the time each one's share is to remain at interest, and multiply the continued product of these amounts by the whole sum for a dividend.

Leave out one of these amounts, and multiply the others continually together; then leave out another of the amounts, and multiply the remaining ones continually together; and thus proceed, leaving out one of the amounts each time, until each of the amounts are respectively left out, and the remaining ones multiplied continually together; then multiply the sum of these products by 100, for a divisor. The quotient will be the equal amount of each one. The present worth of this equal amount, for the time it remains at interest, will be each one's share.

Examples.

1. A man at his decease left $7200, to be divided among his four sons, whose several ages were 14, 17, 18 and 20 years, in such manner that their several portions, when they respectively would arrive to the age of 21 years, should be equal, reckoning interest at 6 per cent. during their minorities—I desire to know the sum bequeathed to each.

$106 amount of $100 for one year.
118 " " three years.
124 " " four years,
142 " " seven years.

$106\times118\times124\times142\times7200 = 1585734220800$ dividend.
$106\times118\times124 = 1550992$ here 142 is left out.
$106\times118\times142 = 1776136$ " 124 is left out.
$106\times124\times142 = 1866448$ " 118 is left out.
$118\times124\times142 = 2077744$ " 106 is left out.

7271320
100

727132000 divisor.

7271320.00)15857342208.00(2180.80.7 received by each
14542640 [at the age of 21.

13147022
7271320

58757020
58170560

58646080
58170560

47552000
50899240

As 106 : 2180.807 :: 100 : 2057.365 bequeathed to him [aged 20 years.
118 : 2180.807 :: 100 : 1848.141 " " 18 years.
124 : 2180.807 :: 100 : 1758.715 " " 17 years.
142 : 2180.807 :: 100 : 1535.779 " " 14 years.
} Answer.

7200.000 whole sum bequeathed.

2. Divide $400 into two such parts, that the amounts will be equal, one being put to interest for one year, and the other for two years, at 6 per cent.

Ans. $205.54 and $194.496.

To find the annual rent which any real property should bring, so as to pay debt, interest and costs in 7 years.

RULE.

Multiply the given debt by .17913, the product will be the annual rent which the property should rent for.

Note.—If real property will rent for as much as will pay the debt and costs, with interest, in seven years, it cannot be legally condemned and sold for debt.

Examples.

1. What annual rent would be sufficient to pay the amount of debt and costs, upon a property amounting in the whole to $558.25¼ cents, in seven years.

558.255×.17913 = 100.00+Answer.

PROOF.

558.255 whole amount of debt and costs.
33.495 interest for one year.
591.750 amount due at the end of the first year.
100.000 rent received the first year.

491.750 balance due after receiving the first year's rent.
29.505 interest on this balance for one year.

521.255 amount due at the end of the second year.
100.000 rent received the second year.

421.255 balance due after receiving the 2d year's rent.
25.275 interest on this balance for one year.

446.530 amount due at the end of the third year.
100.000 rent received the third year.

346.530 balance due after receiving the 3d year's rent.
20.792 interest on this balance for one year.

367.322 amount due at the end of the fourth year.
100.000 rent received the fourth year.

267.322 balance due after receiving the 4th year's rent.
16.039 interest on this balance for one year.

283.361 amount due at the end of the fifth year.
100.000 rent received the fifth year.

183.361 balance due after receiving the fifth year's rent.
11.001 interest on this balance for one year.

194.362 amount due at the end of the sixth year.
100.000 rent received the sixth year.
94.362 balance due after receiving the sixth year's rent.
5.638 interest on this balance for one year.
100.000 amount due at the end of the seventh year.
100.000 rent received the seventh year.

Hence it is evident that the debt, interest and costs are all paid.

2. A property which rented annually for $360, was condemned by a court of enquiry, for an amount of debt against it of $2100—Was the condemnation legal?

$$2100 \times .17913 = 376.173$$ the sum it should rent for annually.

Now, because this sum exceeds $360, the condemnation was legal.

3. What annual rent would be sufficient to pay the amount of debt and costs, (upon a property) amounting in the whole to $12000, with the interest, in seven years?

Ans. $2149.56.

4. A property worth an annual rent of $300, has a debt of $1500 against it—Should it be condemned?

$$\$1500 \times .17913 = \$268.69\tfrac{1}{2}.$$

Now, because this is less than $300, the property should not be condemned.

5. Should a property worth an annual rent of $600, be condemned for a debt of $3400?

$$3400 \times .17913 = \$609.042.$$

Now, because this sum is more than the annual rent, it should be condemned.

ALLIGATION.

Alligation is a rule by which we adjust the prices and simples of compound quantities.

CASE I.

When the quantities and their prices are given, to find the price of a part of the composition.

Rule.

As the sum of the several quantities,
Is to any part of the composition,
So is their total value,
To the value required.

Examples.

1. A merchant mixes 3 C. of Sugar, at $8.25; 1 C. at $7.50; 5 C. at $8.00; and 2 C. at $6.50—I desire to know what 10 C. of this composition is worth.

C.	$	
3	× 8.25	= 24.75
1	× 7.50	= 7.50
5	× 8.00	= 40.00
2	× 6.50	= 13.00
11		85.25 total value.

C. C. $ $
As 11 : 10 :: 85.25 : 77.50 answer.

2. If 12 bushels of corn, at 50 cents per bushel; 100 of oats, at 30 cents; 16 of rye, at 60 cents; and 14 of buckwheat, at 55 cents, be mixed together, what will 22 bushels of the mixture be worth? Ans. $11.127, nearly.

3. A wine merchant mixes 6 gallons of wine, at $1.00 per gallon, with 4 gallons at $1.05, 7 gallons at $1.40, and 5 gallons at $1.50—what is a gallon of this mixture worth? Ans, $1.25.

CASE II.

When the prices of several simples are given, to find how much of each must be taken to make a compound at any proposed price.

Rule.

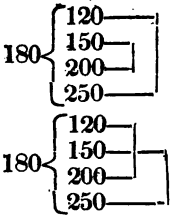
The prices or rates must all be of the same denomination. Set down the prices, one under the other, and the mean rate on the left hand of these. Join or link together the several rates, so that each rate which is less than the mean rate be linked with some one that is greater, or with as many greater as you choose; and each of the greater with some one that is less, or as many less as you choose; the difference, or sum of the differences, between each rate and the mean price, placed opposite the respective rate with which it or they are linked, will be the respective quantities required.

Note 1.—Different modes of linking will produce different answers.

2. Any number of answers may be had, by dividing or multiplying any set of differences, by any common divisor or multiplier; which is evident from the following example.

Examples.

1. A merchant would mix wines at $1.20, $1.50, $2, and $2.50 per gallon, so that the mixture should stand him in $1.80 per gallon—What quantity of each sort must he take?



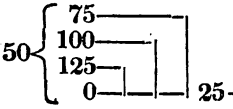
70	or 7,	at $1	20.
20	2,	1	50.
30	3,	2	00.
60	6,	2	50.

20	or 2,	at $1	20.
70	7,	1	50.
60	6,	2	00.
30	3,	2	50.

2. How much rye, at 48 cents per bushel, barley at 36 cts and oats at 24 cents, will make a mixture worth 30 cts. per bushel? Ans. 1 at 48 cts. 1 at 36 cts, and 4 at 24 cts.

3. How much sugar at 4 cts. at 6 cts. and at 11 cts. per lb. must be mixed together, so that the composition may be worth 7 cts. per lb.? Ans. Any weight of equal quantity.

4. It is required to mix several sorts of wine, at 75 cents, $1.00 and $1.25 per gallon, with water, that the mixture may be worth 50 cents per gallon—How much of each sort must the mixture consist of?



50	or 1	at	75	cents.
50	1		100	"
50	1		125	"
25+50+75=150	3	of	water.	

Case III.

When the price of each simple is given, also the quantity of one of them, and the mean rate of the whole compound, to find the several quantities of the rest.

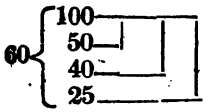
Rule.

Place the several prices one under the other, and the mean rate to the left hand, and take their difference as in case 2; then,

As the difference of the same name with the quantity given
Is to the rest of the differences, respectively,
So is the quantity given
To the several quantities required.

Examples.

1. Twelve bushels of wheat at $1.00, with rye at 50 cts., barley at 40 cts. and oats at 25 cts.—What quantity of these must be mixed with the wheat, to rate at 60 cts. per bushel?



As 65 : 40 :: 12 : $7\frac{5}{13}$ of rye.
65 : 40 :: 12 : $7\frac{5}{13}$ of barley. } Ans.
65 : 40 :: 12 : $7\frac{5}{13}$ of oats.

2. How much alloy, and how much gold, of 21 and 22 carats fine, must be put to 30 ounces, of 20 carats fine, to bring it to 18 carats fine. Ans. 30 oz. of 21, 30 of 22, and 15 oz. of alloy.

3. How much Malaga at $1.12½ per gallon, sherry at $1.00, and white wine at 75 cts. must be mixed with 30 gallons of canary at 87½ cts., so that the mixture may stand in 93¾ cts. per gallon? Ans. 10 gal. at $1.12½, 30 gal. at $1.00, and 10 gal. at 75 cts. per gallon.

Case IV.

When the particular rates of all the ingredients proposed to be mixed, the sum of all their quantities, with the mean rate of that sum being given, to find the particular quantities of the mixture.

Rule.

Set down all the particular rates, with the mean rate as before; find the differences, and add them all into a sum; then,

As the sum of the differences
Is to the difference opposite each rate,
So is the quantity to be compounded
To the required quantity of that price.

Examples.

1. Hiero, king of Syracuse, gave orders for a crown, to be made entirely of pure gold; but suspecting the workmen had debased it, by mixing with it silver or copper, he recommended the discovery of the fraud to the famous Archimedes, and desired to know the exact quantity of alloy in the crown. Archimedes, in order to detect the imposition procured two other masses, the one of pure gold, and the other of silver or copper, and each of the same weight with the former; and by putting each, separately, into a vessel full of water, the quantity of water expelled by them determined their specific

bulks. Now, suppose the weight of each mass to have been 5 lb.; the weight of the water expelled by the alloy, 23 oz.; by the gold, 13 ounces, and by the crown, 16 ounces; that is, that their specific bulks were as 23, 13 and 16: then, what were the quantities of gold and alloy in the crown?

$$16 \left\{ \begin{array}{l} 13 \text{—} \\ 23 \text{—} \end{array} \right. \left. \begin{array}{l} 7 \text{ of gold} \\ 3 \text{ of alloy} \end{array} \right\} \text{ And the sum of these is } 7+3=10, \text{ which should have been but 5.}$$

Whence by the rule,

$$\begin{array}{lccccccl} & \text{oz.} & & \text{oz.} & & \text{lb.} & & \text{lb.} \\ \text{As} & 10 & : & 7 & :: & 5 & : & 3\tfrac{1}{2} \text{ of gold} \\ & 10 & : & 3 & :: & 5 & : & 1\tfrac{1}{2} \text{ of alloy} \end{array} \Bigg\} \text{ Answer.}$$

2. How many gallons of water must be mixed with wine, at $1.00 per gallon, so as to fill a vessel of 100 gallons, that may be afforded at 80 cents per gallon? Ans. 20 gallons.

3. A grocer had 4 sorts of sugar, at 4 cents, 8 cents, 10 cents and 12 cents per lb. the worst would not sell, and the best was too dear; he therefore concluded to mix 90 pounds—What quantity of each must he take, so as to sell at 9 cents per pound?

Ans. 27 lbs. at 4, 9 at 8, 9 at 10 and 45 at 12 cts.
Or, 9 lbs. at 4 cts. 27 at 8, 45 at 10, and 9 at 12.

POSITION.

Position is a rule that by false or supposed numbers, taken at adventure, and worked with according to the nature of the question, discovers the true number sought.

SINGLE POSITION

Teaches to resolve such questions as require only one supposed number, by the following

Rule.

Take any number, and perform exactly the same operations with it, as are described to be performed in the question: then,

As the result of that operation,
Is to the given sum or number,
So is the supposed number,
To the true number required.

Note—If the results of two or more supposed numbers be in the same proportion as the supposed number; or if, upon working with two supposed numbers, and multiplying each of them by the result of the other, the products be equal, then the question may be solved by Single Position; if otherwise, it cannot.

Examples.

1. A gentleman, at his decease, left $3000 to be divided amongst his three sons, whose several ages were 18, 19, and 20 years, in such a manner that their several portions, when they would arrive to the age of 21 years, should be equal, reckoning interest at 6 per cent. during their minorities,—I desire to know the sum bequeathed to each.

Suppose $1000 the sum received by each at the age of 21 years; $106, 112 and 118, the respective amounts of $100 during the time the several bequests are at interest; then,

	$	$	$	$	
As	106	: 1000 ::	100	: 943.396	sum bequeathed to the eldest
	112	: 1000 ::	100	: 892.857	" " second
	118	: 1000 ::	100	: 847.458	" " youngest
				2683.711	according to this supposition.

	$	$	$	$	
As	2683.711	: 3000 ::	1000	: 1117.86,	the sum received by each at the age of 21. Ans.

	$	$	$	$	
As	106	: 1117.86 ::	100	: 1054.58	bequeathed to the eldest.
	112	: 1117.86 ::	100	: 998.09	" " second.
	118	: 1117.86 ::	100	: 947.33	" " youngest.
				3000.00	whole sum bequeathed, according to the question.

2. A gentleman bought a chaise, horse and harness, for 240 dollars; the horse came to twice the price of the harness, and the chaise came to the price of the horse and harness—What did he pay for each?

Ans. Harness, $40; horse, $80; chaise, $120.

3. A., B. and C. bought a quantity of goods for $420, and agreed among themselves that C. should have a third part

more than A., and B. should have as much as them both—I desire to know how much each must pay.

Ans. A. $90; B. $120, and C. $210.

4. The yearly interest of a sum of money at 6 per cent. exceeds $\frac{1}{20}$ of its principal by $40—I wish to know the principal. Answer, $4000.

5. A gentleman bought two pieces of cloth, containing together 60 yards; the price of one of the pieces was $3.00 per yard, and of the other $5.00 per yard, and the value of each piece was the same—How many yards were in each piece, and what the total amount? Ans. $37\frac{1}{2}$ yards in one.
$22\frac{1}{2}$ " in the other.
$225 total amount.

6. In an orchard of fruit trees, $\frac{1}{2}$ of them bear apples, $\frac{1}{4}$ pears, $\frac{1}{5}$ plums, 30 of them peaches, and 40 cherries—How many trees does the orchard contain? Ans. 1000.

7. What is the age of a person who says that if $\frac{1}{3}$ of the years I have lived be multiplied by 4, and $\frac{2}{3}$ of them be added to the product, the sum will be 82? Ans. 41 years.

DOUBLE POSITION

Is by making use of two supposed numbers, and if both prove false, (as it generally happens,) they are, with their errors, to be thus ordered:

Rule 1.

1. Place each error against its respective supposed number.
2. Multiply them crossways.
3. If the errors be alike, that is, both too much or too little, take their difference for a divisor, and the difference of the product for a dividend; but if unlike, take their sum for a divisor, and the sum of the products for a dividend; the quotient will be the answer.

Note 1.—If 0 be used for the first and 1 for the second supposed number, the first of the errors, divided by their difference, will, (in many instances,) be the answer.

Note 2.—Multiply the difference of the supposed numbers by the least error, and divide the product by the difference of the errors, if like, or by the sum, if unlike; the quotient is

the correction of the number belonging to the least error, which error is to be added or subtracted according as that number was too little or too great.

Examples.

1. A gentleman has two horses, worth $200: he has also a saddle, which, if put upon the first horse, makes his value double that of the second; and if put upon the second horse, makes his value equal to the first—I wish to know the value of each horse, also the value of the saddle.

First—Suppose $110, for the value of the first horse,
Then will 90 be the value of the second horse.

180 the value of the first horse and saddle.
110 value of the first horse.

70 value of the saddle alone.
90 value of the second horse.

160 value of the second horse and saddle, which, according to the question, is equal to the first horse.
110 value of the first horse.

50 error too little.

Again—Suppose $125 for the value of the first horse.
Then will 75 be the value of the second horse.
2

150 value of the first horse.
125 value of the second horse.

25 value of the saddle.
75 value of the second horse.

100 value of the second horse and saddle, which, according to the question, is equal to the first horse.
125 value of the first horse.

25 error too much.

Sup. Errors.
110 × 50 = 6250
125 × 25 = 2750

75) 9000 (120 Ans. Value of the first horse.
75 80 Value of the second horse.
2
150
150 160 value of the first horse and saddle.
120 value of the first horse.
0
40 value of the saddle.

By Note 2.

125 one of the supposed numbers. 50 greater error.
110 the other. 25 less error.

15 difference. 75 sum of the errors.
25 least error.

75
30

75)375(5 correction belonging to the least error; which is to
375 be subtracted, because the number is too great.

Hence 125—5 = 120 value of the first horse, as before.

2. A man had 2 silver cups, weighing together 20 ounces, and having one cover for both, now if the cover be put on the lesser cup, it will be half the weight of the greater cup; and set it on the greater cup, it will be five times as heavy as the lesser cup—What is the weight of each cup; also of the cover? Ans. Lesser cup, 4 ounces.
Greater cup, 16 "
Cover, 4 "

3. A young gentleman having asked his father how old he was, received the following reply: 12 years ago my age was in a four-fold ratio to yours; but if we should both happen to live 6 years hence, my age will be just double to yours.—I desire to know their several ages. Ans. 48 and 21 years.

4. A gentleman caught a fish, whose head was 8 inches long, the tail as long as the head and half the body, the body was just the length of the head and tail—What was the length of the whole fish? Ans. 5 feet 4 inches.

5. A. B. and C. discoursing of their ages, A. affirmed that he was 22 years of age; B. said his age was equal to that of A. and half the age of C.; and C. affirmed that he was as old as both A. and B.—What was the age of each person?

Ans. A. 22, B. 66, and C. 88.

ARITHMETICAL PROGRESSION.

ARITHMETICAL PROGRESSION is a rank or series of numbers which increase or decrease regularly, by a common difference, that is, by the continual adding or subtracting of an equal number.

In arithmetical progression five things are to be observed, viz.

1. The first term.
2. The common difference.
3. The last term.
4. The number of terms.
5. The sum of all the terms.

Any three of which being given, the rest may be found.

Note—When any even number of terms differ, by arithmetical progression, the sum of the two extremes will be equal to the sum of the two middle numbers, or any two means equally distant from the extremes; as 3, 5, 7, 9, 11, 13; where 7+9, the two middle numbers, are = 3+13, the two extremes, and = 5+11, the two means = 16.

When the number of terms are odd, the double of the middle term will be equal to the two extremes, or of any two means equally distant from the middle term; as 1, 2, 3, 4, 5, where the double of 3 = 5+1 = 2+4 = 6.

CASE I.

The first term, common difference, and number of terms given, to find the last term, and sum of all the terms.

RULE.

Subtract the common difference from the product of the number of terms, multiplied by the common difference, the remainder, added to the first term, gives the last term. Multiply the sum of the two extremes, (the first and last

terms) by the number of terms, and half the product will be the sum of the series.

Examples.

1. Twenty-five persons bestowed charity to a poor man; the first gave him 10 cents, the second 12, and so on in arithmetical progression—What did the last person give, and what sum did the man receive?

25 number of terms.
2 common difference.

50
2 common difference.

48
10 first term.

58 last term, or last person gave.
10

68
25 number of terms.

2)1700

$8.50 sum received.

2. A. covenanted with B. to serve him 12 years, and to have $10 the first year, and his wages to increase annually $3, during the term—What had he the last year; what on an average yearly, and what for the whole time?

Ans. { $43 the last year. 26.50 annually. 318 the whole time.

Case II.

When the two extremes and number of terms are given, to find the common difference.

Rule.

Divide the difference of the extremes by the number of terms less one, the quotient will be the common difference.

Examples.

1. Admit a debt be discharged at 14 several payments, in arithmetical progression, the first to be $20, the last $98—What is the common difference, and what the whole debt?

98
20
—
14—1 = 13)78(6 common difference.
78
98
20
—
118
14
—
2)1652
—
$826 whole debt.

GEOMETRICAL PROGRESSION.

When a number of quantities increase by the same multiplier, or decrease by the same divisor, they form a Geometrical Series. This common multiplier, or divisor, is called the ratio. Thus 2, 4, 8, 16, 32, 64, &c. increase by the continual multiplication of 2; and 64, 32, 16, 8, 4, 2, decrease continually by the division of 2, or multiplication of .5.

RULE.

Multiply the first term into such a power of the ratio as is indicated by the number of terms less one, and the product will be the last term.

Multiply the last term by the ratio, from the product subtract the first term, and divide the remainder by the ratio less one; the quotient will be the sum of the series.

Examples.

1. If a man were to engage to pay another 1 cent, for the first month, 6 for the second, 36 for the third, and so on, in a six-fold ratio, for 12 months' service.—How much would his wages amount to?

1	2	3	4	indices.
6	36	216	1296	leading terms.
			1296	
			1679616	eighth power.
			216	
			362797056	11th power and last term.
			6	ratio.
			2176782336	
			1	first term.
6—1 = 5)			2176782335	
			$4353564.67	Answer.

2. A country gentleman wishing to buy some oxen, meets with a person who had 20; he demanded the price of them, and was answered $32 a-piece; the gentleman offers him $30 a-piece, and he would buy all: the other tells him it could not be taken, but if he would give what the last ox would come to, at 1 cent for the first, and doubling to the last, he should have all, which he agreed to.—I wish to know how much he paid for them. Ans. $5242.88.

3. A man agreed with his neighbour for a team of 5 horses; and was to give 9 cents for the first horse, 9 times as much for the second, increasing the price of each horse in a nine-old ratio—What was the price of the team?

Ans. $664.29.

4. If a man was to work 23 days for the following wages, viz. at 1 mill for the first day's work, 3 for the second, 9 for the third, and so on, increasing each day's wages in a three-fold proportion—Required the amount of his wages.

Ans. $47071589.413.

5. The first term of a decreasing geometrical series is 2048, the ratio ½, and the number of terms 12—Required the sum of the series. Ans. 4095.

INVOLUTION,

OR THE METHOD OF RAISING POWERS.

A power is the product arising from multiplying any given number into itself continually a certain number of times; thus,

$4\times4 = 4^2$ the 2d power or square of 4.

$4\times4\times4 = 4^3$ the 3d power or cube of 4.

$4\times4\times4\times4 = 4^4$ the fourth power of 4. &c.

The number denoting the power is called the index of that power.

RULE.

Multiply the number, continually by itself, till the number of multiplication be one less than the index of the power to be found, the last product will be the power required.

Examples.

1. What is the sixth power of 8?

8
8
—
64=2d power,
8
—
512=3d power,
8
—
4096=4th power,
8
—
32768=5th power,
8
—
262144=6th power.

2. Required the 4th power of 14. Ans. 38416.
3. What is the square of 106? Ans. 11236.
4. What is the cube of 97? Ans. 912673.
5. Required the 4th power of 1.5. Ans. 5.0625.
6. A square chamber is 31 feet each way—How many square feet does it contain? Ans. 961.
7. In a plantation 160 perches square, how many square perches? Ans. 25600.

From the foregoing examples, we deem the doctrine of raising powers clear.

EVOLUTION,

OR THE EXTRACTION OF ROOTS.

The root of any number or power, is such a number, as, being multiplied into itself a certain number of times, will produce that number or power. Thus, 4 is the square root of 16, because $4 \times 4 = 16$; and 3 is the cube root of 27, because $3 \times 3 \times 3 = 27$, and so on.

EXTRACTION OF THE SQUARE ROOT.

To extract the square root is to find out such a number, as, being multiplied into itself, the product will be equal to that number.

RULE.

First—Prepare the number for extraction, by pointing it off from the units place, or decimal point, into periods of two figures each; and when the decimal does not consist of an even number of figures, annex a cipher.

Secondly—Seek the greatest square number that is contained in the first point towards the left hand; place the square number under the first point, and the root thereof as a quotient figure; subtract the square number from the first point, and to the remainder bring down the next point for a dividend.

Thirdly—Double the root already found, and place it for a divisor, on the left hand of the dividend, and find how often it is contained in the dividend, exclusive of the place of units; annex the result to the quotient, and also to the divisor; then multiply by the figure last put in the quotient, subtract as in division, and bring down the next period for a new dividend.

Fourthly—Double the ascertained root for a new divisor, and repeat the process to the end.

Note—The root of a vulgar fraction is found by reducing it to its lowest terms, and extracting the root of the numerator for a new numerator, and of the denominator for a new

denominator; a mixt number may be reduced to an improper fraction, and the root thereof extracted as before. If the fraction be a surd, that is, a number where a root can never be exactly found, reduce it to a decimal, and extract the root from it.

The following rule, the same in substance with the foregoing, may perhaps be more easily recollected:

First, to prepare the square, this do,
Point off the figures two by two;
Beneath the last the square next less
Put, and its root in the quotient place;
From the last period take the square,
Then the next lower period there
To the remainder must be brought;
Be this a dividend: the quote
Doubled must the divisor be
To all but units place; then see
How oft the greater holds the less,
That figure must the quote express,
And the divisor units too,
Then as in plain division do,
Thus every period one by one
We manage, and the work is done.

PROOF.

Square the root, adding in the remainder, (if any,) which will equal the number given.

Examples.

1. What is the square root of 185511.1041?

185511.1041(430.71 Answer.
16

83)255
249

8607)61110
60249

86141)86141
86141

2. Required the square root of 10.

```
10.00000000 (3.16228   Answer, nearly.
 9
---
61)100
   61
---
626)3900
   3756
---
6322)14400
    12644
---
63242)175600
     126484
---
632448)4911600
       5059584
```

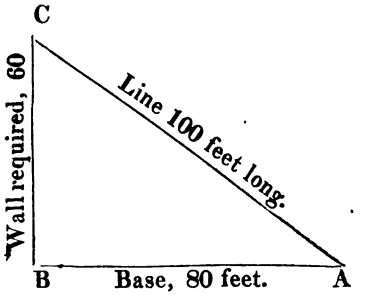
3. What is the square root of 299082436? Ans. 17294.
4. What is the square root of 49491225? Ans. 7035.
5. Required the square root of 41370624. Ans. 6432.
6. What is the square root of 11881? Ans. 109.
7. Required the square root of 10759.56022089. Ans. 103.7283.
8. Required the square root of 2.5? Ans. 1.58114.
9. How much is the square root of 257? Ans. 16.0312.
10. Required the square root of 99.99. Ans. 9.9995.
11. What is the square root of $\frac{10816}{380025}$? Ans. $\frac{8}{13}$.
12. What is the square root of .00172? Ans. .0131148.

Further use of the Square Root.

13. If 1024 trees be planted in a square orchard, how many must be planted in a row each way? Ans. 32.
14. Required the length of a side of a square acre of land. Ans. 69 yards, 1 ft. $8\frac{1}{2}$ in.+

Note.—The square of the longest side of a right angled triangle is equal to the sum of the squares of the other two sides; and consequently the difference of the squares of the longest and either of the other sides, is the square of the remaining side.

15. A line of 100 feet in length extends from the top of a wall to a point 80 feet from its base—What is the height of the wall?



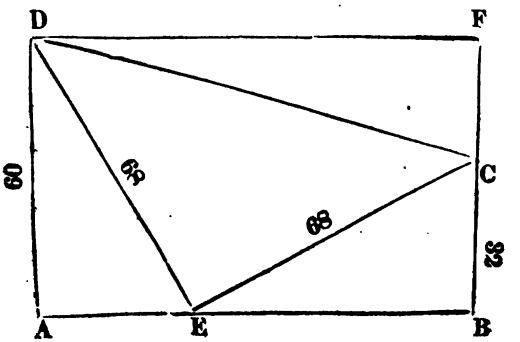
$100 \times 100 = 10000$ square of AC.
$80 \times 80 = 6400$ square of AB.

3600 square of BC.
$\sqrt{3600} = 60 = BC$. Answer.

16. A line of 365 yards in length, will exactly reach from the top of a fort, known to be 27 yards high, to the opposite bank of a river—The breadth of the river is required.

Ans. 364 yards.

17. Suppose a ladder 68 feet long be so placed as to reach a window 32 feet from the ground, on one side of the street, and without moving it at the foot, will reach a window 60 feet high on the other side—What is the breadth of the street, and what is the distance from one window to the other?



$68 \times 68 = 4624$ square of ED.
$60 \times 60 = 3600$ square of AD.

1024 square of AE.
$\sqrt{1024} = 32 =$ AE.
$68 \times 68 = 4624$ square of EC.
$32 \times 32 = 1024$ square of BC.

3600 square of EB.
$\sqrt{3600} = 60 =$ BE.
AE + EB = AB.
32 + 60 = 92 breadth of the street. Ans.

DF = AR = 92, and BF = AD, consequently
CF = AD—BC = 28.
$92 \times 92 = 8464$ square of DF.
$28 \times 28 = 784$ square of CF.

9248 square of DC.
and $\sqrt{9248} = 96.167 =$ DC, as required.

18. A castle wall there was, whose height was found,
To be an hundred feet from the top to the ground;
Against the wall a ladder stood upright,
Of the same length the castle was in height;
A waggish youth did the ladder slide,
The bottom of it ten feet from the side;
Now I would know how far the top did fall,
By pulling out the ladder from the wall.
Ans. 6 inches +

Effects of Light and Heat.

The effects or degrees of light, heat and attraction are reciprocally proportional to the square of their distance from the centre whence they propagated.

19. In a room where two men, A. and B. are sitting, there is a fire, from which A. is two feet and B. is four feet distant; it is required to find how much hotter it is at A's feet than at B's. Ans. A's is 4 times as hot as B's.

20. The distance between the earth and sun is accounted 95 millions of miles; I wish to know what distance from the sun another body must be placed, so as to receive light and heat double to that of the earth. Ans. 67175144 miles.

Velocities of heavy bodies falling.

The velocity of heavy bodies falling near the surface of the earth, is 16 feet in the first second; and, As 16 feet are to the given distance, So is the square of one second, or 1, To the square of the seconds required.

21. In what time will a bullet, dropped from the top of a steeple 324 feet high, come to the ground?

ft. ft. sec. sec.
As 16 : 324 :: 1 : $20\frac{1}{4}$ and $\sqrt{20\frac{1}{4}} = 4\frac{1}{2}$ Ans.

22. A bullet dropped from the top of a building, was found to come to the ground in $2\frac{1}{2}$ seconds—Required its height.

sec. sec. ft. ft.
As 1 : $2\frac{1}{2} \times 2\frac{1}{2}$ :: 16 : 100 Answer.

23. Ascending bodies are retarded in the same ratio that descending bodies are accelerated; therefore, if a ball discharged from a gun, returns to the earth in 10 seconds—How high did it ascend? Ans. 400 feet.

EXTRACTION OF THE CUBE ROOT.

To extract the cube root, is to find out a number which being multiplied into itself, and then into that product, produceth the given number.

Rule.

1. Point every third figure of the cube number given, beginning at the units place or decimal point, seek the greatest cube of the left hand period or to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder for a dividend.

2. Square the root and multiply it by 3 for a defective divisor; see how often the said defective divisor is contained in the said number, (the units and tens excepted) which place in the quotient, and its square to the right of the said divisor, supplying the place of tens with a cypher, if the square be less than ten.

3. Complete the divisor, by adding thereto the product of the last figure of the root by the rest, and by 30. Multiply and subtract as in Division; bring down the next period, for which find a divisor as before, and so proceed with every period.

Note. After the first, the defective divisors may be found more concisely, thus: To the last complete divisor add the number which completed it, with twice the square of the last figure in the root: the sum will be the next defective divisor.

Examples.

1. What is the cube root of 676836152?

676836152 (878
512

Defective divisor and square of 8 = 19249)164836
+1680 = complete divisor 20929)146503

Defective divisor and square of 7 = 2270764)18333152
+20880 = complete divisor 2291644)18333152

2. What is the cube root of 926859375? Ans. 975.
3. What is the cube root of 2077552.576? Ans. 1276.
4. What is the cube root of .015252992? Ans. .248.
5. What is the cube root of 1371.74211248? Ans. 11.111.+
6. What is the cube root of 794022984? Ans. 926+
7. What is the cube root of 15.926972504? Ans. 2.516+
8. What is the cube root of 27054.036008? Ans. 30.02.
9. What is the cube root of 36155.027576? Ans. 33.06+
10. What is the cube root of .001906624? Ans. .124.
11. What is the cube root of 33.230979637? Ans. 3.215+
12. What is the cube root of 53157376? Ans. 376.

To extract the Cube Root of a Vulgar Fraction.

RULE.

Reduce the fraction to its lowest terms, then extract the cube root of its numerator and denominator for a new numerator and denominator; but if the fraction be a surd, reduce it to a decimal, and then extract the root from it.

Examples.

13. What is the cube root of $\frac{2000}{5488}$? Ans. $\frac{5}{7}$.
14. What is the cube root of $\frac{64}{125}$? Ans. $\frac{4}{5}$.
15. What is the cube root of $\frac{16}{250}$? Ans. $\frac{2}{5}$.
16. What is the cube root of $\frac{24}{81}$? Ans. $\frac{2}{3}$.

SURDS.

17. What is the cube root of $\frac{7}{9}$? Ans. .822+
18. What is the cube root of $\frac{4}{7}$? Ans. .829+
19. What is the cube root of $\frac{2}{3}$? Ans. .873+
20. What is the cube root of $\frac{2}{5}$? Ans. .736+

DUODECIMALS.

Duodecimals is a rule by which workmen and artificers take the dimensions, and cast up the content of their work. It is also used for finding the tonnage of ships, and the content of bales, cases, &c. The denominations are:

12 fourths ''''	make 1 third, '''
12 thirds	1 second, ''
12 seconds	1 inch, in.
12 inches	1 foot.

RULE.

Set the feet of the multiplier under the lowest name of the multiplicand, and in multiplying carry 1 for every 12; placing the results of the lowest name in the product, under its multiplier, or,

Multiply by the feet and take parts for the inches, &c.

Note.—Feet multiplied by feet give feet.
Feet multiplied by inches give inches.
Feet multiplied by seconds give seconds.
Inches multiplied by inches give seconds.
Inches multiplied by seconds give thirds.
Seconds multiplied by seconds give fourths.

Examples.

1. How many square feet in a board 14 feet 7 inches long, and 1 foot 5 inches broad?

ft.	in.	
14	7	
1	5	
6	0	11
14	7	
Ans. 20	7	11

Or thus:

4 in.	$\frac{1}{3}$	14	7	
1	$\frac{1}{4}$	×1	6	
		14	7	
		4	10	4
		1	2	7
	Ans,	20	7	11

2. Required the superficial contents of a walnut board, 11 feet 4 inches long, and 1 foot 6 inches broad. Ans. 17 ft.

3. What is the solid content of a load of wood, measuring 6 feet 6 inches in length, 3 feet 4 inches in width, and 3 feet 6 inches in height? Ans. 75 ft. 10 in.

4. How many yards of yard wide paper will it take to paper a ceiling 47 feet 6 inches long, by 25 feet 6 in. wide?

ft.	in.		ft.	in.		ft.	in.
47	6	×	25	6	=	1211	3

ft.	in.		yds.	ft.	
Then 1211	3	÷	9	= 134	5¼ Answer.

5. A mahogany board measures 16 feet 10 inches, by 3 feet 2 inches—What is its content? Ans. 53 ft. 3 in. 8″.

PROMISCUOUS QUESTIONS.

1. There is a square pavement, containing 110889 square stones, all of the same size—I demand the number contained in one of its sides. Ans. 333.

2. If 40 yards of broadcloth cost $240, what must it be sold at per yard, to gain 20 per cent. by the whole? Ans. $7.20.

3. If 12 apples are worth 21 pears, and 3 pears cost one cent, what is the price of 100 apples? Ans. 58⅓ cts.

4. A gentleman at his decease left $3000 to his 3 sons, whose ages were as follows: A. 18 years, B. 19 and C. 20 years; the guardian had directions to divide this sum in such a manner that the share of each, by being put to interest at 6 per cent. should be equal when they should respectively arrive to the age of 21 years—I wish to know how much each must receive at this age; also the sum bequeathed to each.

Ans. Each must receive $1117.86.
Bequeathed to A, 947.33.
" " B, 998.09.
" " C, 1054.58.

5. A. and B. jointly purchase 300 acres of land for $600, each paying $300: when they came to divide the land between them, it was agreed upon, that A. should have his choice, and the part he took was valued at 75 cents per acre more than

B's—I wish to know the price per acre of each one's land, and the number of acres falling to each.

Rule for solving all questions of this nature.

1. Divide the sum paid by each, by the whole number of acres, and add the quotient to one half of the difference in the price per acre, and reserve the number.

2. Multiply the sum paid by each by the difference in the price per acre; divide the product by the whole number of acres, and deduct the quotient from the square of the reserved number; then extract the square root of this remainder, and add the root to the reserved number, and the sum will be the value of A's land per acre.

3. Deduct the difference in the price per acre of their land, from the value of A's land per acre, and the remainder will be the value of B's land per acre.

4. Divide the sum paid by each by their respective prices per acre, and the quotients will be the number of acres falling to them respectively.

Note.—This rule applies to all questions of the above nature, whatever the articles purchased may be, if the name of the article or articles purchased be understood, and used instead of acre or acres.

```
300)300      2).75 difference in price.
    ---       ---                          300 sum paid by each.
    1         .875                         .75 difference in price
    .375                                   ---
    -----                              300)225
    1.375 reserved number.                 ---
    1.375                                  .75
    -----
    1.890625 square of the reserved number.
    .75                                                Acres.
    --------                           300÷2.443 = 122.8 A.
    1.140625(1.068                     300÷1.693 = 177.2 B.
    1         1.375 reserved number.
    -----     -----
206)1406      2.443 Ans. Price of A's land.
    1236        .75
    ----      -----
2128)17025 1.693 price of B's land.
     17024
```

6. Two drovers, A. and B. purchased 100 cattle between them for $2400, each paying $1200; they divided them between them in such a way that A's stood him in $10 a head more than B's—I wish to know what each of their cattle stood them in per head, and how many fell to each.

Answer. A's, $30.00 per head.
B's, 20.00 " "
A had 40 head.
B 60 "

7. A. B. and C. wrought 365 days between them, at the following wages, viz. A. 50 cents, B. 60, and C. 70 cents per day; they each wrought such a length of time as to receive the same wages,—I wish to know the amount of each one's wages and the time he wrought.

Answer. Each received $71.635.
A. wrought 143.27 days.
B. " 119.39 "
C. " 102.34 "

Rule for solving all questions of this nature, whether the number of persons be three or more.

1. Take the continued product of the wages and time for a dividend.

2. Leave out the daily wages of one and multiply the wages of the others continually together, and thus continue leaving out the wages of one and multiplying the others, until the wages of each are respectively left out, and the others multiplied together, then add together these products for a divisor.

3. The quotient will be the amount of each one's wages for the time he wrought.

4. Divide this quotient by each ones daily wages, the quotient will respectively be the time each wrought.

8. A person willing to distribute some money among some indigent persons, wanted 20 cents to give them 20 cents a piece he therefore gave them 19 cents a piece and had 19 cents left—How many were there of them? Ans. 39.

9. A sheep fold was robbed three successive nights; the first night, half the sheep were stolen and half a sheep more; the second, half the remainder and half a sheep more; the last night they took half that were left, and half a sheep more; by this time they were reduced to 12; how many were there at first? Ans. 103.

10. A can mow an acre of grass in 12 hours, B can mow an acre in 8 hours—how long would it take both of them to mow an acre?

H. H. A. A.
As 12 : 72 :: 1 : 6 would be mown by A in 72 hours.
8 : 72 :: 1 : 9 would be mown by B in 72 hours.

15 by both of them in 72 hours.

A. A. H. H. M.
Then as 15 : 1 :: 72 : 4 48 Answer.

11. A gentleman sold a horse for $ 80. by which he cleared as much per cent as the horse cost him. I wish to know how much that was? Ans. $ 52.47.

Rule for such questions.

Multiply the price sold for, by 100, add 2500 to the product, and extract the square root of the sum, then deduct 50 from this root for the prime cost.

12. A toper finding a cask of brandy containing one hundred gallons, filled a keg therefrom, and refilled the cask with water; coming a second and a third time, he did likewise; after which the owner coming to try the proof, found it half water; query, how much did the toper's keg hold?

Ans. 20.63 gallons.

Rule for such questions.

Raise the quantity first in the cask to such a power that the index may be one less than the kegs filled from it. Multiply this power by the quantity left in the cask; take such a root of this product as is indicated by the number of kegs filled, and deduct the root from the quantity first in the cask; the remainder will be the contents of the keg.

13. How much rye at 60 cents a bushel, must be given in barter for 120 bushels of wheat, at $ 1.00 per bushel?

Ans. 200 bushels.

14. A person having engaged to remove 800 C. a certain distance in 9 days; with 18 horses in 6 days he removed 450 C.—how many horses will be required to remove the remainder, in the remaining 3 days? Ans. 28 horses.

15. If a board be 9 inches broad, what length will it require to measure 6 square feet? Ans. 8 feet.

16. What money at 5½ per cent will clear $ 431.55 in 8 years? Ans. $ 990.75.

17. A man dying, left $10000 to be divided amongst his three sons, (whose ages were 19, 16 and 10 years respectively,) in such a manner that their several portions when they became 21 years of age might be equal, reckoning interest at 6 per cent, during their minorities—required the share of each.

Ans. $2660.235
3396.916
3942.849

18. At what times of the day do the hour and minute hands of a watch form a continued straight line?

h. h. m. h. m. h. m. h. m.
Ans. At 6, 7 $5\frac{5}{11}$ 8 $10\frac{10}{11}$, 9 $16\frac{4}{11}$, 10 $21\frac{9}{11}$
h. m. h. m. h. m. h. m. h. m. h.
11 $27\frac{3}{11}$ 0 $32\frac{8}{11}$ 1 $38\frac{2}{11}$ 2 $43\frac{7}{11}$ 3 $49\frac{1}{11}$ and 4 $54\frac{6}{11}$

19. If a roll of butter weighs in one scale 4 pounds, and being changed into the other, weighs $6\frac{1}{4}$ pounds—what is the true weight? Ans. 5 pounds.

Rule for such questions.

Extract the square root of the product of their respective weights.

20. An Eagle is about an inch broad; how many of them laid edge to edge, would reach from New Italy to Harrisburg, a distance of 55 miles? Ans. 3484800.

21. Admitting the state debt to be $25000000, how long would it take one man to count the money sufficient to pay it in half dollars, allowing him to count 60 per minute, and to be engaged 12 hours each day?

Ans. 1157 da. 4 h. 13 m. 20 sec.

22. The distance from the market house in Harrisburg to the Susquehanna bridge is 200 yards; from thence down the river bank to the Black Horse tavern 497 yards—I wish to know the distance upon a straight line from the Black Horse to the market house, admitting it to be a right angled triangle, of which the given distance are the legs.

Ans. 535.73 yds. +

23. Suppose two drovers, A. and B., purchase 100 cattle equally between them for $2400, and divide the cattle in such a way that one of A's and one of B's are worth $ 50—I wish to know how many fell to the lot of each, and how much per head they were valued at? Ans. A. 40, valued at $ 30.
B. 60, ... 20.

24. I demand the height of a wall, against the top of which a ladder, 26 feet long, is so placed as to stand 10 feet from the bottom of the wall. Ans. 24 feet.

25. If the length of a building be 40 feet, and its breadth 30, what distance should it measure from corner to corner diagonally? Ans. 50 feet.

26. Bought a quantity of goods, amounting to $26000, at $\frac{1}{2}$ per cent, commission—what is my commission?

Ans. $130.

27. A gentleman courted a young lady, and as their birth days happened together, they agreed to make that their wedding day. On the day of their marriage it happened that the gentleman's age was to that of the lady's as 3 to 2. After they had lived together 9 years, the gentleman observed that his age was then to hers as 4 to 3, and at their death the gentleman's age was to the lady's as 8 to 7—I demand their several ages at the day of their marriage, and of their death.

Ans. 27 and 18 years were their respective ages at marriage, and 72 and 63 at their death.

28. Sold 99 yards of cloth for $600, which was at 24 per cent profit—What was the prime cost per yard?

Ans. 4.88\frac{3}{4}$+

29. A may-pole there was, whose height I would know,
The sun shining clear, straight to work I did go;
The length of the shadow upon level ground,
Just sixty five feet, when measured, I found;
A staff I had there, just five feet in length,
The length of its shadow was four feet one tenth;
How high was the may-pole, I gladly would know,
And it is the thing you are desired to show.

Ans. 79.268 ft.+

30. If $100 be divided amongst four persons, in the proportion of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$; required the share of each.

Ans. 35\frac{5}{57}$, 26$\frac{6}{19}$ 21$\frac{1}{19}$ and 17$\frac{31}{57}$

31. The Harrisburg Hotel and Red Lion tavern, (Harrisburg,) are on the same side of Market street, at opposite corners of Market and Third streets: directly opposite the Red Lion, is a dry goods store; I wish to know how far it is from the Harrisburg hotel to the dry goods store, admitting the breadth of Market street to be 27 yards. and Third street 18 yards.

Ans. 32.45 yds. nearly.

BOOK-KEEPING.

That method of book-keeping here treated upon, is called Single Entry. Every person in, or intended for, business, should by all means learn and understand it completely. The Day Book and Ledger are the principal books of accounts; the forms of which may be sufficiently comprehended by inspecting the following specimens.

THE DAY-BOOK.

In the day-book every person is written down debtor to the things he has received from you on trust, and creditor by the things which you receive from him. The dates are placed in the middle of the page.

THE LEDGER.

This is the grand book of accounts: all the several debts and credits of each particular person's accounts, which lie scattered through different parts of the day-book, are here collected together, into spaces allotted for them, and placed in such an order as will show the whole state of the account at once.

POSTING.

Your books being ruled in the proper form, commence with the first person who stands *Dr.* or *Cr.* in the day-book, and write his name at the head of the entry, and the contraction Dr. or Cr. in the columns assigned them, according to the following specimen; then if the person be Dr., begin the entry with *To;* place the amount in the Dr. columns, and place the month and day in the same line with the article; also place the number of the page of the day-book in the column assigned it. When the person is Cr., enter it in like manner, beginning the entry with *By*, placing the amount in the Cr. column,

and page of the day-book as before directed. Any account that consists of more than one article, should be written To or By Sundries, and the sum of the amounts in its proper column. Lastly, turn to the alphabet, and under the proper letter insert the name and number of the page of the ledger in which the entry is made, leaving a proper space under each person's name, to receive more accounts, if necessary. Do the same with the next entry in the day-book, and so on till all be finished, (excepting such as are marked "paid.")

When a name occurs for which an account is already opened in the ledger, post the item or items to that account, unless the place assigned it is full; and then remove it to another page, writing at the bottom "Transferred to," and at the head of the page or subsequent entry, write "Brought from," in each case placing the number of the page at the end of the words, which must be understood to have no reference to the day-book, but pertaining to the transfer only; the amount of the columns must also be cast up and transferred into the respective columns assigned them, and opposite the words "Brought from." When ledger A is filled, transfer the unsettled accounts to ledger B; and so on from ledger B to C, &c. as occasion may require.

NEW ITALY, January 1, 1836. 1

			D.	C.
	Peter Fulton,	*Dr.*		
	To 16 gallons Oporto Wine, at $1 25,	$ 2 50		
1	12 do. White do. at 1 40,	16 80		
	6 do. Lisbon do. at 1 00,	6 00		
			42	00
	8			
	Jonathan Jenks,	*Dr.*		
	To 2 pounds of Tea, at $1 25 per lb,	2 50		
1	12 do. Sugar, at 10 cts.	1 20		
	12 do. Coffee, at 12½ cts.	1 50		
			5	20
	18			
	Ralph Bentley,	*Dr.*		
1	To 16 lbs. of Hard Soap, at 10 cts.	1 60		
	12 lbs. Starch, at 6 cts.	72		
			2	32
	20			
	Matthew Twight,	*Cr.*		
1	By 650 bushels of Lime, at 12 dolls. per hundred,		78	00
	"			
	Sarah Yeoman,	*Dr.*		
1	To 11 lbs. of Rice, at 5 cts.	0 55		
	6 do. Coffee, at 11 cts.	66		
	12 do. Brown Sugar, at 8 cts.	96		
			2	17
	23			
	Timothy Hedge,	*Dr.*		
2	To 17 yards of Tow Linen, at 20 cts.	3 40		
	25 do. Cotton Stripe, at 17 cts.	4 25		
	21 do. Coarse Flannel, at 30 cts.	6 30		
			13	95
	24			
	Morris Davis,	*Cr.*		
2	By 25 bu. of dried Peaches, at $2 50,	37 50		
	20 do. " Apples, at 87½ cts.	17 50		
			55	00
	25			
1	*Peter Fulton,*	*Cr.*		
	By 24 bushels of Wheat, at $1 10,		26	40

2 NEW ITALY, January 25, 1836.

			D.	C.
	Jonathan Jenks,	*Dr.*		
1	To 6 pounds of Coffee, at 13 cents,	$0 78		
	10 do. Loaf Sugar, at 15 cts.	1 50		
			2	28
	27			
	Isaac Kling,	*Dr.*		
2	To 46 pounds of Ham, at 9 cents,	4 14		
	20 do. Flitch, at 7 cents	1 40		
			5	54
	30			
	Susan Embers,	*Dr.*		
2	To 14 yards of Cambric, at 50 cents,	7 00		
	3 do. Calico, at 28 cents,	84		
			7	84
	"			
	Christian Cornwall,	*Dr.*		
2	To 1 barrel of Vinegar, - - - -		4	00
	February 1.			
	Matthew Twight,	*Dr.*		
	To 12 bbls. of superfine Flour, at $6 25,	75 00		
1	3 do. Rye " at 3 25,	9 75		
			84	75
	2			
	Valentine Vezey,	*Cr.*		
2	By 120 pounds of Tobacco, at 14 cts. - -		16	80
	3			
	Timothy Hedge,	*Cr.*		
	By 6 cords of Hickory Wood, at $2 50,	15 00		
2	4 do. Oak do. 1 75,	7 00		
			22	00
	4			
Paid.	*Martha Pullback,*	*Dr.*		
	To ¼ pound of Tea, - - - - -			30
	5			
	Jason Sproul,	*Dr.*		
	To 1½ pounds of Indigo, at $2 80,	4 20		
3	50 do. Logwood, at 5 cts.	2 50		
	80 do. Fustic, at 7 cts.	5 60		
	60 do. Nicaragua, at 20 cts.	12 00		
			24	30

NEW ITALY, February 6, 1836. 3

		D.	C.
	Matthew Twight, Cr.		
1	By an order on Charles Rakestraw, for - -	70	00
	"		
	Charles Rakestraw, Dr.		
3	To Matthew Twight's order on him, for -	70	00
	"		
	Joseph Quigley, Cr.		
3	By a Rhode Island Cheese, weight 40 lbs. at 12 cents per pound, $4 80		
	12 bushels of Beans, at $1 25, 15 00	19	80
	"		
	William Ingles, Dr.		
3	To 6 gallons of Brandy, at $1 50, 9 00		
	5 do. Madeira Wine, at 1 60, 8 00	17	00
	7		
	Valentine Vezey, Dr.		
	To 5 gallons of Tar, at 27 cents, 1 35		
2	1 do. Train Oil, 75		
	20 pounds of Sulphur, at 5 cts. 1 00	3	10
	8		
	Louisa Wirt, Dr.		
	To 10 yds. of Cambric Muslin, at 80 cts. 8 00		
4	11 do. Coarse do. at 12 cts. 1 32	9	32
	10		
	George Price, Dr.		
	To 5 pounds of Raisins, at 12 cents, 0 60		
4	12 do. Candles, at 11 cts. 1 32		
	16 ounces of Blueing, at 20 cts. 3 20	5	12
	11		
	Charles Rakestraw, Dr.		
3	To 43 reams of double Medium Paper, at $4 25 per ream, 182 75		
	16 do. Super royal Paper, at 3 75, 60 00	242	75

4 NEW ITALY, February 11, 1836.

			D.	C.
4	*Zachariah Andrews,*	*Dr.*		
	To 25 bushels of Potatoes, at 25 cts.	$6 25		
	16 do. Turnips, at 18 cts.	2 88		
			9	13
	13			
4	*Davis Mahan,*	*Dr.*		
	To 105 bushels of Wheat, at $1 05,	110 25		
	63 do. Buckwheat, at 60 cts.	37 80		
			148	05
	"			
3	*Joseph Quigley,*	*Dr.*		
	To cash in part, - - - - - -		16	00
	15			
4	*John Lemon,*	*Dr.*		
	To a set of China,	5 00		
	15 China Bowls,	1 80		
			6	80
	17			
1	*Matthew Twight,*	*Dr.*		
	To 50 bushels of Wheat, at $1 05,	52 50		
	21½ do. Rye, 50,	10 75		
			63	25
	18			
4	*Henry Gill,*	*Dr.*		
	To 14 yards of coarse Linen, at 20 cts.	2 80		
	6 do. fine do. 50 "	3 00		
			5	80
	24			
2	*Morris Davis,*	*Dr.*		
	To 66 yards of Cambric Muslin, at 80 cents,		52	80
	26			
3	*Zephaniah Norcross,*	*Dr.*		
	To 1 C. 1 qr. 16 lb. of Iron, at $6 per C.		8	46
	27			
6	*Uriah Umstead,*	*Dr.*		
	To 26 cords of Oak Wood, at $2 50,	65 00		
	12 cords Hickory do. 3 25,	39 00		
			104	00
	28			
2	*Timothy Hedge,*	*Dr.*		
	To cash in full,		8	05

			D.	C.
	William Ingles,	*Cr.*		
3	By 16 pounds of Butter, at 16 cts.	$2 56		
	12 do. Lard, at 10 cts.	1 20		
			3	76
	March 2.			
	Hannah Old,	*Dr.*		
5	To 16 yards of Muslin, at 17 cents,	2 72		
	5 dozen Eggs, at 9 cents,	45		
			3	17
	3			
4	*George Price,*	*Cr.*		
	By 19 bushels of potatoes, at 25 cents,		4	75
	4			
	Jason Sproul,	*Dr.*		
3	To 19 yards red Flannel, at 60 cents,	11 40		
	14 do. white do. 55 cts.	7 70		
			19	10
	7			
3	*William Ingles,*	*Dr.*		
	To 13 yards of Black Satin, at	$1 05	13	65
	8			
4	*Davis Mahan,*	*Cr.*		
	By 1564 bushels of Lime, at $12 per 100 bushels,		187	68
	10			
	Zephaniah Norcross,	*Dr.*		
3	To 12 yards of Silk, at $1,	12 00		
	5 do flowered Silk, at $1 05,	5 25		
			17	25
	12			
	Hannah Old,	*Dr.*		
5	To 6 yards of Chintz, at $1 07,	6 42		
	5 do. black Satin, at $1 00,	5 00		
			11	42
	15			
4	*Davis Mahan,*	*Dr.*		
	To cash in full, - - - - - - -		39	63
	17			
5	*Hannah Old,*	*Cr.*		
	By Cash in full, - - - - - -		14	59

6 NEW ITALY, March 19, 1836.

			D.	C.
	Andrew Zug,	*Dr.*		
5	To 24 Comly's Spelling Books, at 20 cts.	$4 80		
	3 quires Writing Paper, at 21 cts.	63		
				543
	20			
	Charles Rakestraw,	*Cr.*		
3	By a Bank Check for		300	00
	27			
	Ralph Bentley,	*Dr.*		
1	To 1½ yards of Broadcloth, at $4 50,	6 75		
	1½ dozen Coat Buttons, at 32 cts.	48		
				723
	30			
	Henry Gill,	*Dr.*		
	To 12 pounds of hard Soap, at 9 cts.	1 08		
4	14 do. white do. at 14	1 96		
	12 do. Starch, at 7	84		
	13 do. Candles, at 12	1 56		
				544
	April 3.			
	Jonathan Jenks,	*Dr.*		
1	To 27 pounds of Cheese, at 9 cents,			243
	5			
	Isaac Kling,	*Cr.*		
2	By 164 bushels of Lime, at $12 per 100 bushels,		19	68
	8			
	Louisa Wirt,	*Cr.*		
4	By cash in part, - - - - - -		5	00
	9			
	Sarah Yeoman,	*Dr.*		
	To 2 pounds of Sugar, at 10 cents,	20		
1	1 do. Coffee, 13 do.	13		
	3 do. Candles, 12 do.	36		
	2 do. Starch, 7 do.	14		
	1 do. Raisins, 12 do.	12		
				95
	11			
	Zachariah Andrews,	*Cr.*		
4	By 64 pounds of Beef, at 5 cents,	3 20		
	16 do. Sausage, at 7 cents,	1 12		
				432

			D.	C.
2	*Christian Cornwall,*	*Cr.*		
	By cash in full, - - - - - -		4	00
	17			
	Jonathan Jenks,	*Cr.*		
1	By a gray Horse,	$50 00		
	15 pounds of Butter, at 15 cents,	2 25		
			52	25
	20			
	John Lemon,	*Dr.*		
4	To 13 yards of Tow Linen, at 25 cents,	3 25		
	12 do. Coarse Muslin, at 11 cts.	1 32		
			4	57
	25			
	Uriah Umstead,	*Cr.*		
5	By cash in part, - - - - - -		50	00
	30			
	Susan Embers,	*Cr.*		
2	By cash in part, - - - - - -		5	00
	May 1.			
	Valentine Vezey,	*Dr.*		
2	To 4 yards of Broadcloth, at $3,	12 00		
	1½ dozen Coat Buttons, at 40 cents,	60		
	22 pounds of Rice, at 5 cents,	1 10		
			13	70
	7			
	Jonathan Jenks,	*Cr.*		
1	By 1200 bushels of Lime, at $12,		144	00
	9			
	Isaac Kling,	*Cr.*		
2	By cash in part, - - - - - -		20	00
	10			
	Morris Davis,	*Dr.*		
2	To 20 pounds of Cheese, at 11 cents,		2	20
	16			
	John Lemon,	*Cr.*		
4	By cash in full, - - - - - -		11	37
	17			
	Andrew Zug,	*Dr.*		
5	To a Cheese, weight 45 pounds, at 9 cts.		4	05

8 NEW ITALY, May 17, 1836.

			D.	C
4	*Zachariah Andrews,*	*Cr.*		
	By 2 cords of Oak Wood, at $2,	$4 00		
	Hauling do.	81		
			4	81
	June 10			
	Susan Embers,	*Cr.*		
2	By 6 pounds of Butter, at 14 cents,	84		
	Cash in full,	2 00		
			2	84
	18			
	Henry Gill,	*Dr.*		
5	To 42 Mackerel, at 4 cents.	1 68		
	16 pounds of Candles, at 12 cents,	1 92		
	2 gallons Lamp Oil, at 60 cents,	1 20		
	3 quarts Tar, at 8 cents,	24		
			5	04
	27			
	George Price,	*Dr.*		
4	To 11 pounds of Coffee, at 16 cents,	1 76		
	2 do. Loaf Sugar, at 14 cts.	28		
	5 do. Brown Sugar, at 9 cts.	45		
			2	49
	July 1.			
	Thomas T. Mahan,	*Dr.*		
Paid.	To 3 yards blue Broadcloth, at $5 50,	16 50		
	2½ do. brown Pollard, at 20 cts.	50		
	1½ do. Silk, at $1,	1 60		
			18	50
	10			
	Louisa Wirt,	*Cr.*		
4	By 18 yards of Linen, at 24 cents,		4	32
	27			
	Andrew Zug,	*Cr.*		
5	By 16 yards coarse Linen, at 20 cents,	3 20		
	4 do. fine do. at 45 cents,	1 80		
			5	00
	August 1.			
	Zephaniah Norcross,	*Cr.*		
3	By 149 pounds of Bacon, at 9 cents,		13	41

			D.	C.
	Joseph Quigley,	*Dr.*		
3	To 1 hogshead Madeira Wine, 110 gallons, at $1 10 per gallon,		121	00
	8			
	Jason Sproul,	*Dr.*		
3	To 5 yards Scarlet Cloth, at $4 50,	$22 50		
	4 do. Velvet, at 1 03,	4 12		
	3 do. Corduroy, at 1 06,	3 18		
			29	80
	20			
	William Ingles,	*Dr.*		
3	To 14 yards of Calico, at 30 cts.	4 20		
	1 pair Men's Gloves,	50		
			4	70
	27			
	Henry Gill,	*Cr.*		
5	By 14 yards of Muslin, at 15 cents,	2 10		
	15 do. Linen, at 40 cents,	6 00		
			8	10
	September 1.			
	Ralph Bentley,	*Cr.*		
1	By 191 pounds of Beef, at 5 cents,		9	55
	4			
	Peter Fulton,	*Dr.*		
1	To 5 pounds of Candles, at 12 cents,	60		
	14 do. Coffee, at 12 cents,	1 68		
			2	50
	12			
	Isaac Kling,	*Dr.*		
2	To 13 yards Irish Linen, at 75 cents,	9 75		
	12 do. Muslin, at 15 cents,	1 80		
			11	55
	October 23.			
	Uriah Umstead,	*Cr.*		
5	By 450 bushels of Lime, at 12 cents,		54	00
	30			
	Sarah Yeoman,	*Dr.*		
1	To 5½ yards Calico, at 30 cents,	1 65		
	2 do. Cambric, at 60 cents,	1 20		
			2	85

10 NEW ITALY, November 1, 1836.

		D.	C.
	William Ingles, Cr.		
	By a cask of Wine, containing 15¼ gallons,		
3	at $1 per gallon, $15 50		
	Cash in full, 16 09		
		31	59
	4		
	Jonathan Jenks, Dr.		
1	To 40 Sheep, at $2 40, - - - -	96	00
	17		
	Jason Sproul, Cr.		
3	By cash in full, - - - - - -	73	20
	26		
	Andrew Zug, Cr.		
5	By cash in full, - - - - - -	4	48
	December 1.		
	Peter Fulton, Cr.		
1	By cash in full, - - - - - -	18	10
	11		
	Joseph Quigley, Cr.		
3	By cash in full, - - - - - -	117	20
	16		
	Zephaniah Norcross, Cr.		
3	By cash in full, - - - - - -	12	30
	22		
	Henry Gill, Cr.		
5	By cash in full, - - - - - -	8	18
	24		
	Daniel Cope, Dr.		
Paid.	To 12 pounds of Raisins, at 11 cents, 1 32		
	3 do. Loaf Sugar, at 16 cents, 48		
		1	80
	25		
	Cornelius Walton, Dr.		
Paid.	To 12 pounds Candles, at 12½ cents, 1 50		
	14 do. Sugar, at 10 cents, 1 40		
		2	90
	31		
	Sarah Yeoman, Cr.		
1	By 15 yards of Linen, at 29 cents, 4 35		
	18 pounds Bacon, at 9 cents, 1 62		
		5	97

LEDGER A.

THE ALPHABET.

A.		B.	
Zachariah Andrews,	4	Ralph Bentley,	1
C.		D.	
Christian Cornwall,	2	Morris Davis,	2
E.		F.	
Susan Embers,	2	Peter Fulton,	1
G.		H.	
Henry Gill,	4 5	Timothy Hedge,	2
I & J.		K.	
Jonathan Jenks,	1	Isaac Kling,	2
William Ingles,	3		
L.		M.	
John Lemon,	4	Davis Mahan,	4
N.		O.	
Zephaniah Norcross,	3	Hannah Old,	5
P.		Q.	
George Price,	4	Joseph Quigley,	3
R.		S.	
Charles Rakestraw,	3	Jason Sproul,	3
T.		U.	
Matthew Twight,	1	Uriah Umstead,	5
V.		W.	
Valentine Vezey,	2	Louisa Wirt,	4
Y.		Z.	
Sarah Yeoman,	1	Andrew Zug,	5

1 LEDGER A.

1836.	folio	PETER FULTON.	DR.	Cr.
Jan. 1,	1	To sundries,	$ 42 00	
" 25,	1	By 24 bushels of Wheat,		$26 40
Sept. 4,	9	To sundries,	2 50	
Dec. 1,	10	By cash in full,		18 10
			44 50	44 50
1836.		JONATHAN JENKS.		
Jan. 8,	1	To sundries,	5 20	
" 25,	2	To sundries,	2 28	
April 3,	6	To 27 pounds of Cheese,	2 48	
" 17,	7	By sundries,		52 25
May 7,	7	By 1200 bushels of Lime,		144 00
Nov. 4,	10	To 40 Sheep,	96 00	
	1	Transferred to Ledger B,	105 91	196 25
1836.		RALPH BENTLEY.		
Jan. 18,	1	To sundries,	2 32	
March 27	6	To sundries,	7 23	
Sept. 1,	9	By 191 pounds of Beef,		9 55
			9 55	9 55
1836.		MATTHEW TWIGHT.		
Jan. 20,	1	By 650 bushels of Lime,		78 00
Feb. 1,	2	To sundries,	84 75	
" 6,	3	By order on Chas. Rakestraw		70 00
" 17,	4	To sundries,	63 25	
			148 00	148 00
1836.		SARAH YEOMAN.		
Jan. 20,	1	To sundries,	2 17	
April 9,	6	To sundries,	95	
Oct. 30,	9	To sundries,	2 85	
Dec. 31,	10	By sundries,		5 97
			5 97	5 97

LEDGER A. 2

1836.	fol.	TIMOTHY HEDGE.	DR.	CR.
Jan. 23,	1	To sundries,	$13 95	
Feb. 3,	2	By sundries,		22 00
Feb. 28,	4	To cash in full,	8 05	
			22 00	22 00
1836.		MORRIS DAVIS.		
Jan. 24,	1	By sundries,		55 00
Feb. 24,	4	To 66 yards Cambric Muslin	52 80	
May 10,	7	To 20 pounds Cheese,	2 20	
			55 00	55 00
1836.		ISAAC KLING.		
Jan. 27,	2	To sundries,	5 54	
April 5,	6	By 164 bushels Lime,		19 68
May 9,	7	By cash in part,		20 00
Sept. 12,	9	To sundries,	11 55	
	1	Transferred to Ledger B,	16 09	39 68
1836.		SUSAN EMBERS.		
Jan. 30,	2	To sundries,	7 84	
April 30,	7	By cash in part,		5 00
June 10,	8	By sundries in full,		2 84
			7 84	7 84
1836.		CHRISTIAN CORNWALL,		
Jan. 30.	2	To 1 barrel of Vinegar,	4 00	
April 15,	7	By cash in full,		4 00
			4 00	4 00
1836.		VALENTINE VEZEY.		
Feb. 2,	2	By 120 pounds Tobacco,		16 80
Feb. 7,	3	To sundries,	3 10	
May 1,	7	To sundries in full,	13 70	
			16 80	16 80

3 LEDGER A.

1836.	fol.	JASON SPROUL.	DR.	CR.
Feb. 5,	2	To sundries,	824 30	
March 4,	5	To sundries,	19 10	
Aug. 8,	9	To sundries,	29 80	
Nov. 17,	10	By cash in full,		873 20
			73 20	73 20
1836.		CHARLES RAKESTRAW.		
Feb. 6,	3	To Matthew Twight's order,	70 00	
Feb. 11,	3	To sundries,	242 75	
March 20	6	By a bank check,		300 00
	1	Transferred to Ledger B.	312 75	300 00
1836.		JOSEPH QUIGLEY,		
Feb. 6,	3	By sundries,		19 80
Feb. 13,	4	To cash in part,	16 00	
Aug. 5,	9	To a hogshead Madeira wine,	121 00	
Dec. 11,	10	By cash in full,		117 20
			137 00	137 00
1836.		WILLIAM INGLES.		
Feb. 6,	3	To sundries,	17 00	
Feb. 29,	5	By sundries,		3 76
March 7,	5	To 13 yards Black Satin,	13 65	
Aug. 20,	9	To sundries,	4 70	
Nov. 1,	10	By sundries,		31 59
			35 35	35 35
1836.		ZEPHANIAH NORCROSS.		
Feb. 26,	4	To 1 C. 1 qr. 16 lb. Iron,	8 46	
March 10	5	To sundries,	17 25	
Aug. 1,	8	By 149 pounds of Bacon,		13 41
Dec. 16,	10	By cash in full,		12 30
			25 71	25 71

LEDGER A. 4

1836.	fol.	LOUISA WIRT.	DR.	CR.
Feb. 8,	3	To sundries,	$9 32	
April 8,	6	By cash in part,		$5 00
July 10,	8	By 18 yards of Linen,		4 32
			9 32	9 32
1836.		GEORGE PRICE.		
Feb. 10,	3	To sundries,	5 12	
March 3,	5	By 19 bushels Potatoes,		4 75
June 27,	8	To sundries,	2 49	
	1	Transferred to Ledger B.	7 61	4 75
1836.		ZACHARIAH ANDREWS.		
Feb. 11,	4	To sundries,	9 13	
April 11,	6	By sundries,		4 32
May 17,	8	By sundries,		4 81
			9 13	9 13
1836.		DAVIS MAHAN.		
Feb. 13,	4	To sundries,	148 05	
March 8,	5	By 1564 bushels of Lime,		187 68
March 15	5	To cash in full,	39 63	
			187 68	187 68
1836.		JOHN LEMON.		
Feb. 15,	4	To sundries,	6 80	
April 20,	7	To sundries,	4 57	
May 16,	7	By cash in full,		11 37
			11 37	11 37
1836.		HENRY GILL.		
Feb. 18,	4	To sundries,	5 80	
March 30	6	To sundries,	5 44	
		Transferred to folio 5,	11 24	

5 LEDGER A.

	fol.	HENRY GILL.	DR.	CR.
		Brought from folio 4,	$11 24	
June 18,	8	To sundries,	5 04	
Aug. 27,	9	By sundries,		8 10
Dec. 22,	10	By cash in full,		8 18
			16 28	16 28
1836.		URIAH UMSTEAD.		
Feb. 27,	4	To sundries,	104 00	
April 25,	7	By cash in part,		50 00
Oct. 23,	9	By 450 bushels of Lime		54 00
			104 00	104 00
1836.		HANNAH OLD.		
March 2,	5	To sundries,	3 17	
March 12	5	To sundries,	11 42	
March 17	5	By cash in full		14 59
			14 59	14 59
1836.		ANDREW ZUG.		
March 19	6	To sundries	5 43	
May 20	7	To a Cheese, weight 45 lbs.	4 05	
July 27	8	By sundries,		5 00
Nov. 26,	10	By cash in full,		4 48
			$9 48	$9 48

BALANCING.

1836.	STOCK.	DR.	CR.
Dec. 31,	To Jonathan Jenks, due to him,	$90 34	
	By Isaac Kling, due to him	23 59	
	By Charles Rakestraw, due to me		$12 75
	By George Price, due to me		2 86
		113 93	15 61
		15 61	
	Balance due me,	$98 32	

When Ledger A is filled, (as was said before,) transfer the amount of the unsettled accounts to another ledger, distinguished by Ledger B. The alphabet may be made similar to the alphabet for Ledger A.

The pages from whence the account is transferred should be placed in the folio column, in the same line with the entry, as in the following specimen:

LEDGER B. 1

1836.	fol.	JONATHAN JENKS.	Dr.	Cr.
	1	Brought from ledger A,	$105 91	$196 25
1836.	fol.	ISAAC KLING.	Dr.	Cr.
	2	Brought from ledger A,	$16 09	$39 68
1836.	fol.	CHAS. RAKESTRAW.	Dr.	Cr.
	3	Brought from ledger A,	$312 75	300 00
1836.	fol.	GEORGE PRICE.	Dr.	Cr.
	4	Brought from ledger A.	$7 61	$4 75

☞ Besides the foregoing, there are several other books kept by most merchants; as the Cash Book, Expense Book, Invoice Book, &c. &c.

MERCANTILE FORMS.

BILLS OF PARCELS.

When goods are sold, it is customary for the seller to deliver to the buyer, a note of their contents and prices, with a total of their value cast up; this is called a bill of parcels.

New Italy, Jan. 1st, 1836.

Jason M. Mahan,

Bought of F. W. Leopold,

12 yards superfine broad cloth, at	$4 50	$54 00
3 do. blue muslin,	25	75
20 skeins sewing silk,	6	1 20
10 balls cotton thread,	4	40
		$56 35

Unionville, January 12th, 1836.

James Faxon,

Bought of Charles Postmaster,

20 pounds of chocolate, at	$0 20	$4 00
6 do. coffee,	16	96
34 do. sugar,	11	3 74
2¼ do. hyson tea,	1 20	2 70
Amount,		$11 40

By 12 pounds butter, at	20cts.	2 40	
18 do lard,	12	2 16	
			4 56
Balance,			6 84

Received payment in full,

CHARLES POSTMASTER.

BOOK BILL.

A Book Bill is the copy of the account that one person has against another, and is made out from the book accounts, and presented for settlement and payment.

1835. Rasselas Thomas, Dr.

To Henry S. Faulks, & Co.

Jan. 6th,	To 4 yards superfine cloth, at	$4 25	$17 00
May 14th,	To 5 do. Irish linen,	85	4 25
July 23d,	To 12 do. Russia sheeting,	40	4 80
Sept. 26th,	To 30 pounds rice,	5	1 50
			$27 55

1836.

May 16th, Received payment in full,

HENRY S. FAULKS.

BILL OF LADING.

Shipped in good order, by A. Boardman, on the good ship *Washington*, A. Boardman, master, now riding at anchor in the bay of Funchal, and bound for Boston, to say,

C, D. No. 1 a 50 5 quarter casks of wine,
C. B. No. 1 a 4 4 pipes of wine,

Being marked and numbered as in the margin, and are to be delivered in the like good order (dangers of the seas, fire and enemies excepted) at the aforesaid port of Boston, unto C. Denman or his assigns, he or they paying freight for the said goods, with primage and average accustomed. In witness whereof, the master of said ship hath affirmed to three bills of lading, of this tenor and date, the one of which being accomplished, the other two to be void.

A. BOARDMAN.

Funchal, July 10th, 1836.

Sales of sundry merchandize at Funchal, on account of C. Denman, merchant, of Boston; being part of the cargo of the ship Washington.

		$ cts.
100 barrels of Beef, at 16 dolls.		1600 00
150 barrels of Pork, at 20 dolls.		3000 00
10000 feet of White Pine Boards, at 25 dolls.		250 00
		4850 00
Expenses.		
Boat hire,	$10 00	
Cooperage,	5 50	
Commission at 5 per cent.	242 50	
		258 00
Nett sales,		$4592 00

Funchal, June 6th, 1836.

Errors excepted,

A. BOARDMAN.

Invoice of wines shipped at Funchal, on board the ship Washington, by A. Boardman, master of said ship, on account and risques of C. Denman, a native citizen of the United States, resident at Boston, and consigned to him.

Marks.		$ cts.
C. D.		
No. 1 a 50	50 qr. casks of Wine, at $30,	1500 00
C. B. No. 1 a 4	4 pipes Wine, 120,	480 00
		1680 00
	Expenses.	
	Commission at 2½ per cent. $49 50	
	Boat hire for shipping Wine, 1 60	
		51 10
	Funchal, June 1st, 1836.	2031 10

Errors excepted,

A. BOARDMAN.

Disbursements of the ship Washington, A. B. master.

1836.	*At Funchal.*	$ cts.
May 1	To a Shipping Paper,	0 60
4	To Ballast,	12 00
6	To Block Maker's bill,	14 00
	To Blacksmith's bill,	16 00
8	To Ship Chandler's bill,	16 15
11	To Butcher's bill,	11 11
		$69 86

	At Madeira.	$ cts.
April 1	To fresh Meat and Vegetables,	2 12
	To one cask of Wine for ship's use,	15 00
		$18 12

1836.	*G. Dunn, owner of ship Washington.*	Dr.	Cr.
May 11	To disbursements of the ship Washington, at Funchal,	$69 86	
	To do. at Madeira,	18 12	
	To wine, as per invoice,	2031 10	
	To a bill of exchange for £100 sterling, drawn by E. F., merchant, Funchal, on G. N., merchant, London, at par,	444 44	
June 6	By net sales of merchandize at Funchal,		4592 00
	To balance due the owners of said ship,	2028 48	
	Funchal, June 6, 1836. Errors excepted, A. Boardman, master.	4592 00	4592 00

1836.	*J. Codline, mate of ship Washington.*	Dr.	Cr.
April 1	To 1 qr. cask of Wine,	30 00	
14	By two barrels Beef sold for $16 per barrel,		32 00
	To cash, to balance,	2 00	
		$32 00	$32 00

CONVEYANCING.

A Seaman's Receipt.

Received at Boston, May 6th, 1836, of Aaron Boardman, master of the ship Washington, fifty dollars, in full for wages, and in full satisfaction for other demands against the owners, master and officers of said ship.

$50 00 JACK HALYARD.

A Receipt in full of all demands.

Received, May 10th, 1836, of Henry Hogan, twenty seven dollars, sixty four cents, in full of all demands.

$27 64 JAMES JUSTICE.

A Receipt for rent.

Received, June 2nd, 1836, of Timothy Hedge, one hundred and fifteen dollars, in full for one year's rent, due the first of April last.

$115 00 PETER TAKEALL.

Another.

Received, October 4th, 1836, of Job Warner, the sum of twenty seven dollars, in money, which, with twenty five dollars and fifty cents more, disbursed by the said Job Warner, for repairs and taxes of the tenements he now occupies, making in the whole fifty two dollars and fifty cents, the same being in full for a half year's rent, due the 1st of October, instant.

$52 50 JOHN RECEIVER.

For money received of a third person.

Received, November 8th, 1835, of Peter Amos, by the hands of Francis Porter, the sum of Ten Dollars, Fifty Cents, on account.

$10 50. JESSE HUGHES.

For Interest due on a Bond.

Received, Jan. 1st, 1836, of James Brooks, the sum of Thirty Dollars, in full for one year's interest of Five Hun-

dred Dollars, due to me the third day of April last, on bond, by the said James Brooks.

$30 00. DAVID WEST.

The form of a common Negotiable Note.

$300— Westchester, Jan. 4th, 1836.

Sixty days after date, I promise to pay to the order of John Robb, Three Hundred Dollars, without defalcation. Value Received.

JAMES JOHNSON.

Promissory Note.

$400— New Italy, January 14th, 1836.

Three months after date I promise to pay to William Gould, or order, the sum of Four Hundred Dollars, for value Received. Witness my hand the 9th of August, one thousand eight hundred and thirty-six.

JOHN PORTER.

(No witness is required.)

Note with Security.

$150—

We, or either of us, promise to pay William Mulberry, or order, One hundred and Fifty Dollars, on the first day of August, one thousand eight hundred and thirty six, with lawfull interest for the same, for value received. Witness our hands this 1st day of December, one thousand eight hundred and thirty six.

SAMUEL RAPP.
HENRY LOVE.

The form of an Accommodation Note to be discounted at the Bank of the United States.

$300— New Italy, January 1st, 1836.

Sixty days after date I promise to pay to the order of Jacob Paxson, Three Hundred Dollars, without defalcation. Value received.

PETER MARTIN.

Credit the drawer,
Jacob Paxson.

FORMS AND DIRECTIONS FOR TRANSACTING BUSINESS AT THE BANK OF CHESTER COUNTY.

Form of an accommodation note.

$100— December 31, 1835.

Sixty days after date, I promise to pay Davis Mahan or order, at the Bank of Chester County, one Hundred Dollars without defalcation, value received.

AMOS PRICE.

Credit the drawer.

Davis Mahan.

Note.—The above note must be endorsed on the back by Davis Mahan previous to its being offered at Bank, and if discounted, will pass to the credit of Amos Price.

Form of a Real or Business Note.

$100— December 31, 1835.

Sixty days after date, I promise to pay Davis Mahan, or order, at the Bank of Chester County, one hundred dollars, without defalcation, value received.

AMOS PRICE.

Note.—The above note must be endorsed on the back by Davis Mahan, previous to its being offered at Bank, and if discounted, will pass to the credit of Davis, or to a subsequent endorser, being the last.

Form of a Draft or inland Bill of Exchange.

$100 December 31, 1835.

At sight pay to the order of Davis Mahan, one hundred dollars, and charge to account of

Yours respectively, AMOS PRICE.

Jesse Watson,
Merchant, Philadelphia.

Another.

$100 December 31, 1835.

Five days after sight, pay to the order of Davis Mahan, one hundred dollars, and charge to my account.

Yours respectfully, AMOS PRICE.

Jesse Watson,
Merchant, Philadelphia.

Note.—Bills payable after date, or after sight, must be presented for acceptance, and if after date, the acceptor writes at the bottom of the Bill or across its face, the word, "accepted," and signs his name; if after sight, the acceptor must write at the bottom of the Bill, or on its face, thus, "accepted, January 5, 1836, Jesse Watson." Such Bills must always be endorsed by the payee, who in the foregoing cases is Davis Mahan, and if discounted, will pass to the credit of Davis, or of a subsequent endorser.

Form of a Power of Attorney to transfer Stock.

Know all men by these presents, that I, Elisha Harper, of the township of Salisbury, in the county of Chester, and State of Pennsylvania, do hereby constitute and appoint Amos Price my true and lawful Attorney for me and in my name to sell, assign and transfer unto Davis Mahan ten shares of my stock in the Bank of Chester county.

Witness my hand and seal this 31st day of December, one thousand eight hundred and thirty five.

Sealed and delivered in the presence of Peter Dale, Samuel Frent. } ELISHA HARPER.

Form of a Bill Single with Warrant of Attorney.

This Bill binds me, Amos Price, of the township of East Marlborough, in the county of Chester, and State of Pennsylvania, to the Bank of Chester County, in said State, and its assigns in the sum of two hundred dollars of lawful money of the United States of America, conditioned for the payment of one hundred dollars of lawful money aforesaid, (with lawful interest*) on the thirteenth day of March next ensuing. And I do hereby authorise any Attorney of any Court of Record of this State, or elsewhere, to appear for me, and after one or more declarations filed for the above penalty, thereupon to confess judgment or judgments for the same, in

* If the Note is to be discounted the words in brackets will be omitted.

favor of the Bank of Chester County aforesaid, and its assigns, against me with costs of suit and release of errors.

Witness my hand and seal this thirty-first day of December, in the year of our Lord, one thousand eight hundred and thirty five.

Sealed and delivered in the presence of Thomas Seal, Amos Davis.

AMOS PRICE.

Form of a Proxy.

I, Amos Price, of East Marlborough, in the county of Chester, do hereby authorise John Gill for me and in my name, to vote for Directors of the Bank of Chester county, at the ensuing election, as fully as I could if personally present.

Witness my hand and seal, February 1st, 1836.

Sealed and delivered in the presence of Samuel Eachus, William James.

AMOS PRICE.

Note—Proxies must be given and dated within 60 days of the election.

Form of a Power of Attorney to receive Dividends.

I, Amos Davis, of the township of Charlestown, county of Chester, do hereby constitute and appoint James Henna my attorney to ask, demand and receive from the Bank of Chester county the dividends due [or that may become due*] to me on my stock in said bank, and to give full and sufficient discharges for the same.

Witness my hand and seal this 31st day of August, one thousand eight hundred and thirty-five.

Sealed and delivered in the presence of Joseph Flowers, John Mahan.

AMOS PRICE.

*The words in brackets may be inserted if the power is intended to be perpetual; otherwise they may be omitted.

Form of a Check.

December 31, 1835.

Bank of Chester county, pay to Amos Price or bearer, one hundred dollars.

$100. DAVIS MAHAN.

Another.

December 30, 1835.

Bank of Chester county, pay to Amos Price or order, one hundred dollars.

$100. DAVIS MAHAN.

Note.—This check must be endorsed by Amos Price, or it will not be paid.

Note with Interest.

$80—

I promise to pay to Samuel Jackson or order, the sum of Eighty Dollars, on demand, with interest till paid, for value received. Witness my hand, this 7th day of July, one thousand eight hundred aad thirty-six.

WILLIAM CARR.

Judgment Note.

I promise to pay Matthias Long, or order, Nine Hundred Dollars, on the first day of April, one thousand eight hundred and thirty six, with lawful interest for the same. For value received. And further, I do hereby empower any attorney of the court of Common Pleas of Chester county, or any other court of record of Pennsylvania, to confess judgment for the above sum and costs, with release of errors, &c. Witness my hand and seal this 1st day of June, one thousand eight hundred and thirty five.

Sealed and delivered in the presence of } JACOB WATTS.
John A. Moore,
Owen Johnson.

Note 1.—Promissory notes are assignable by endorsement; that is, any person to whom a note is given, may assign it to a second person, by endorsing or writing his name on the

back of it; and the second may do the same, and so on from the third to the fourth, &c.: this gives the last assignee a right against all the antecedent parties.

Note 2.—A note may be assigned either before it becomes due or afterwards. When assigned before it is due, no circumstances existing between the antecedent parties will in any wise affect the assignee: when assigned after it is due, the assignee receives the note subject to all the equitable rights existing between the said parties.

Note 3.—A sealed note is not debarred by the statute of limitation, and is paid in the settlement of a decedent's estate in preference to a note without a seal.

Notice from a Landlord to a Tenant.

SIR,—Being in possession of a certain house and lot of ground, with the appurtenances, belonging to me, situate in the township of Sadsbury, in the county of Chester, which was demised to you by me, for the term of one year, which said term will expire and terminate on the first day of April; I hereby notify you that it is my desire to have again and repossess the said premises, and I do hereby demand and require you to leave the same.

Witness my hand this first day of January, one thousand eight hundred and thirty-five.

JOHN RIGG.

Mr. Isaac Bear.

$400. *New Italy, October* 17, 1835.

Sixty days after sight, pay to Lemuel Hastings, or order, this my first bill of exchange for Four Hundred Dollars, (second, third and fourth, of the same tenor and date, not being paid,) for value received, without further advice from

Your humble servant,

LEWIS JOHNS.

To James Platt, Esq. Philadelphia.

Proxy to vote for Directors of the Bank of the United States.

Know all men by these presents, that I, Samuel Dale, of Chester county, have constituted, appointed, and do hereby constitute and appoint John Cope, of Philadelphia, to be my

true and lawful substitute and proxy for me, and in my name to vote at any election for Directors of the Bank of the United States, or any other question that may be put, at a stated or special meeting of the stockholders of the said bank, as full as I might or could do if present. Witness my hand this first day of June, one thousand eight hundred and thirty-five.

Assignment of a Bond or Bill.

I do hereby assign and set over all my right, title, claim, interest, property and demand whatsoever, in and to the within bond, (or bill,) unto David Haines, for value received. Witness my hand and seal, this first day of July one thousand eight hundred and thirty-five.

JOHN CRABB.

Note.—Assignments must be made under the hand and seal of the assignor, and in the presence of two or more credible witnesses.

Common and Judgment Bond.

Know all men by these presents, That I, Henry Painter, of the township of Earl and county of Lancaster, State of Pennsylvania, am held and firmly bound unto Benjamin Linville of the township of Salisbury, in the County and State aforesaid, in the sum of two thousand dollars, lawful money of Pennsylvania, to be paid to the said Benjamin Linville, or to his certain attorney, executors, administrators or assigns. To which payment well and truly to be made, I bind myself, my heirs, executors and administrators, and every of them, firmly, jointly, and severally by these presents. Sealed with my seal; dated the first day of April, in the year of our Lord one thousand eight hundred and thirty-five.

The condition of this obligation is such, that if the above bounden Henry Painter, his heirs, executors, administrators, or any of them, shall and do well and truly pay, or cause to be paid, unto the above named Benjamin Linville, or to his certain attorney, executors, administrators or assigns, the sum of one thousand dollars, like money as aforesaid, on or before the first day of April next ensuing the date hereof, with lawful interest, without any fraud or further delay;

then the above obligation to be void, or else to be and remain in full force and virtue.

[The above is the Common Bond; and the Judgment Bond will be completed by attaching to it the following:]

And further, I do hereby empower any attorney of the Court of Common Pleas of Lancaster county, or any other Court of Record of Pennsylvania or elsewhere, to appear for me, and after one or more declarations filed for the above penalty, thereupon to confess judgment or judgments, as of last, next, or any subsequent term, with stay of execution until the day of payment herein before contained, with release of errors, &c.

Sealed and delivered in the presence of

Assignment of a Bond.

FOR a valuable consideration, to me in hand paid by Henry Seymour, I do hereby assign and set over the within obligation and all the moneys due thereon, unto the said Henry Seymour, his heirs and assigns. And in case the same cannot be recovered of Henry Painter, the obligor within named, then I promise and agree to pay the amount hereof with all charges thereupon accruing, unto the said Henry Seymour, his heirs and assigns. Witness my hand and seal, this first day of April, one thousand eight hundred and thirty five.

BENJAMIN LINVILLE.

For a Bond mislaid or lost.

The condition of this obligation is such, that whereas Henry Painter, in and by a certain obligation, bearing date on or about the first day of August, became bound unto Benjamin Linville in the sum of Two Thousand Dollars, which said bond is since lost or mislaid. And whereas the said Henry Painter hath fully satisfied and paid the sum of One Thousand Dollars, with its interest, due on the said obligation, the receipt whereof the said Benjamin Linville doth hereby ac-

knowledge, and thereof, and from every part thereof, and all actions, suits and demands concerning the same, doth acquit and forever discharge the said Henry Painter, his heirs, executors and administrators, by these presents. If, therefore, the said Benjamin Linville, his heirs, executors and administrators shall and do deliver up the said obligation, when it shall be found, to the said Henry Painter, his heirs, executors and administrators, to be cancelled; and until the same shall be so delivered up and cancelled, shall save, defend, keep harmless, and indemnify the said Henry Painter, his heirs, executors and administrators, and his and their goods and chattels, lands and tenements, of and from the said obligation, and of and from all actions, suits, payments, costs, charges and damages, for or by reason thereof. Witness my hand and seal, the third day of December, one thousand eight hundred and thirty-five.

BENJAMIN LINVILLE.

Sealed and delivered in presence of

Indenture of an Apprentice.

This Indenture witnesseth, that James Long, of the township of Lower Makefield, in the county of Bucks, son of Francis Long, by and with the consent of his father, as testified by his signing as a witness hereunto, hath put himself, and by these presents doth voluntarily, and of his own free will and accord, put himself apprentice to Samuel Downs, of the same place, Blacksmith, to learn his art, trade and mystery, and after the manner of an apprentice to serve him from the day of the date hereof, for and during the full end and term of four years and two months, next ensuing. During all which term the apprentice his said master faithfully shall serve, his secrets keep, his lawful commands every where gladly obey. He shall do no damage to his said master, nor see it done by others, without letting, or giving notice thereof to his said master. He shall not waste his said master's goods, nor lend them unlawfully to any. With his own goods, nor the goods of others, without license from his said master, he shall neither buy nor sell. He shall not absent himself day nor night from his said master's service without his leave; nor haunt ale-houses, taverns or play-houses; but in all things behave himself as a faithful apprentice ought to

do, during the said term. And the said master shall use the utmost of his endeavors to teach or cause to be taught or instructed the said apprentice, in the trade or mystery of a Blacksmith; and procure for him sufficient meat, drink, apparel, lodging and washing fitting for an apprentice, during the said term of four years and two months, and give him within the said term six months' schooling, one-half thereof is to be in the last year of the said term; and when he is free, to give him two suits of clothing, one whereof is to be entirely new. And for the performance of all and singular the covenants and agreements aforesaid, the said parties bind themselves each unto the other, firmly, by these presents. In witness whereof, the said parties have set their hands and seals hereunto—Dated the first day of January, in the year of our Lord one thousand eight hundred and thirty-six.

JAMES LONG.

Sealed and delivered in the
presence of FRANCIS LONG.

Assignment of an Apprentice.

KNOW all men by these presents, that I, the within named Samuel Downs, for divers good causes and considerations, have assigned and set over, and by these presents, as far as I lawfully may or can do, assign and set over the within Indenture, and the apprentice therein named, unto Isaac How, his heirs and assigns. He and they performing all and singular the covenants therein contained on my part and behalf to be done, kept and performed, and indemnifying me from the same. Witness my hand and seal the second day of August, one thousand eight hundred and thirty six.

SAMUEL DOWNS.

Witness present.

Lease of a Farm.

This Indenture, made the first day of January, in the year of our Lord one thousand eight hundred and thirty six, between Jacob Lamb, jr. of the township of West Caln, in the county of Chester, and state of Pennsylvania, yeoman, of the one part, and Isaac Ward, of Sadsbury township, county and state aforesaid, yeoman, of the other part, witnesseth, that

the said Jacob Lamb, jr. for and in consideration of the yearly rent and covenants hereinafter mentioned and reserved on the part and behalf of the said Jacob Lamb, jr. his heirs, executors and administrators, to be paid, kept, and performed, hath demised, set and to farm, let, and by these presents doth demise, set and to farm, let, unto the said Isaac Ward, his heirs and assigns, all that certain messuage or tenement, tract, piece or parcel of land, situate in the township of West Caln, aforesaid, adjoining land of John Lawrence, Job Rapp, Jonathan Watkins and others, and now in the tenure of Isaac Lemon, containing one hundred and ten acres, together with all and singular the buildings, improvements, and other the premises hereby demised with the appurtenances; to have and to hold the same unto the said Isaac Ward, his heirs and assigns, from the first day of April next ensuing the date hereof, for and during the term of five years, thence next ensuing, and fully to be complete and ended; yielding and paying for the same unto the said Jacob Lamb, jr. his heirs and assigns, the yearly rent or sum of two hundred dollars, on the first day of April in each and every year during the term aforesaid: and at the expiration of the said term, or sooner, if determined thereof, he the said Isaac Ward, his heirs and assigns, shall and will quietly and peaceably surrender and yield up the said demised premises, with the appurtenances, unto the said Jacob Lamb, jr. his heirs and assigns, in as good order and repair as the same now are, reasonable wear, tear and casualties which may happen by fire or otherwise, only excepted. In witness whereof the parties have hereunto interchangeably set their hands and seals, the day and year above written.

JACOB LAMB, JR.
ISAAC WARD.

Sealed and delivered in presence of

Lease of a House.

Agreed the first day of March, in the year of our Lord one thousand eight hundred and thirty-six, between Howard Pugh, of Newtown township, in the county of Bucks, and state of Pennsylvania, yeoman, of the one part, and James Parker, of the same place, stone mason, of the other part, as follows: The said Howard Pugh doth let unto the

said James Parker, his heirs and assigns, a certain lot of land, whereon is erected a brick dwelling and stable, situate in the township aforesaid, and now occupied by Henry Janney, adjoining land of John Plumly, for the term of one year from the first day of April next, for the yearly rent of forty dollars, to be paid in four equal quarterly payments, viz: on the first days of July, October, January and April, which said yearly rent the said James Parker doth hereby for himself, his executors and administrators, covenant and agree to pay unto the said Howard Pugh, his heirs, executors and assigns: and at the expiration of the said term, or sooner, he, the said James Parker, his heirs and assigns, shall and will quietly and peaceably surrender and yield up the said demised premises, with the appurtenances, unto the said Howard Pugh, his heirs and assigns, in as good order and repair as the same now are; reasonable wear, tear and casualties which may happen by fire or otherwise, only excepted.

In witness whereof, we have hereunto set our hands and seals the day and year above written.

JAMES PARKER,

Witness present, HOWARD PUGH.

Assignment of a Lease.

Know all men by these presents, That I, Philip Hathaway, the lessee within named, for and in consideration of One Hundred Dollars, to me in hand paid by William Mulberry, at and before the ensealing and delivery hereof, the receipt whereof I do hereby acknowledge, have granted, assigned, and set over, and by these presents do grant, assign, and set over, unto the said William Mulberry, his heirs and assigns, the within indenture of lease, together with all and singular the premises hereby demised, with the appurtenances, to have and to hold the same unto the said William Mulberry, his heirs and assigns, for the residue of the term within mentioned, under the yearly rent and covenants within reserved and contained on my part and behalf to be done, kept, and performed.

Witness my hand and seal the first day of January one thousand eight hundred and thirty-six.

PHILIP HATHAWAY.

Sealed and delivered in presence of

Agreement for sale of an Estate.

Articles of agreement, indented, made, concluded, and agreed upon, the second day of October, in the year of our Lord one thousand eight hundred and thirty-five, between John James, of the township of Warwick, in the county of Bucks, and state of Pennsylvania, yeoman, of the one part, and Alexander Harper, of the township and county aforesaid, merchant, of the other part, as follows, to wit:

The said John James, for the consideration hereinafter mentioned, doth for himself, his heirs, executors and administrators, covenant, promise, grant and agree to and with the said Alexander Harper, his heirs and assigns, by these presents, that he the said John James, shall and will, on or before the first day of April next ensuing the date hereof, at the proper costs and charges of the said John James, his heirs and assigns, by such deed or deeds of conveyance as he or they, or his or their council, learned in law, shall advise, well and sufficiently grant, convey and assure unto the said Alexander Harper, his heirs and assigns, in fee simple, clear of all incumbrances, all that plantation or farm, containing one hundred and ten acres, in the township of Cranberry, in Venango county, adjoining lands of Bela Smith, and now in the tenure of James Siverty, together with all and singular the buildings, improvements, and other the premises hereby demised, with the appurtenances. In consideration whereof, the said Alexander Harper, for himself, his heirs, executors and administrators doth covenant, promise and agree to and with the said John James, his heirs and assigns, by these presents, that he the said Alexander Harper, his heirs, executors and administrators, or some of them, shall and will well and truly pay, or cause to be paid, unto the said John James, his executors, administrators or assigns, the sum of one thousand eight hundred dollars, in manner following, to wit: six hundred dollars, part thereof, on the delivery of the deed for the premises; six hundred dollars more thereof, on the first day of July, which will be in the year of our Lord one thousand eight hundred and thirty-six, and six hundred dollars on the first day of October then next ensuing.

And for the true performance of all and every the covenants and agreements aforesaid, each of the said parties bindeth himself, his heirs, executors and administrators, unto the other, his executors, administrators and assigns, in the penal

sum of three thousand six hundred dollars, firmly by these presents.

In witness whereof, the said parties to these presents have hereunto set their hands and seals. Dated the day and year first above written.

JOHN JAMES.
ALEXANDER HARPER.

Sealed and delivered in the presence of

Agreement for building a House.

Articles of agreement, made and fully agreed upon the second day April, in the year of our Lord one thousand eight hundred and thirty-six, between James Cope, of Middletown township, in the county of Bucks, and state of Pennsylvania, yeoman, of the one part, and Jason Webb, of the township of Tinicum, in the county and state aforesaid, carpenter, of the other part, to wit: The said Jason Webb, for the consideration hereafter mentioned, doth for himself, his executors and administrators, covenant, promise and agree to and with the said James Cope, his executors, administrators and assigns, that he the said Jason Webb, shall and will, within the space of five months next after the date hereof, in good and workmanlike manner, and according to the best of his art and skill, well and substantially erect, build, set up and finish one house or messuage, in Middletown, Bucks county, of the dimensions following: [here insert the dimensions] and compose the same with such stone, brick, timber, and other materials as the said James Cope or his assigns shall find and provide for the same. In consideration whereof, the said James Cope doth for himself, his executors and administrators, covenant and promise, to and with the said Jason Webb, his executors, administrators and assigns, well and truly to pay or cause to be paid, unto the said Jason Webb, his executors, administrators and assigns, the sum of one thousand dollars, in manner following, to wit: five hundred dollars at the beginning of said work; two hundred and fifty dollars more in three months, provided said house be at least one half done, and the remaining two hundred and fifty dollars, in full for the said work, when the same shall be completely finished. And also, that the said James Cope, his executors,

administrators or assigns, shall and will, at his and their own proper expense, find and provide all the stone, brick, tile, timber and other materials necessary for making and building of the said house. And for the true performance of all and singular the covenants and agreements aforesaid, each of the said parties bindeth himself, his heirs, executors and administrators, unto the other, his executors, administrators and assigns, in the penal sum of two thousand dollars firmly by these presents. In witness whereof, we have hereunto set our hands and seals the day and year first above written.

JAMES COPE,
JASON WEBB.

Sealed and delivered in presence of

Agreement with a Clerk or Workman.

It is agreed, this first day of January, in the year of our Lord one thousand eight hundred and thirty-six, between David Irwin and Job Young, both of the borough of Westchester, and county of Chester, in manner following, to wit: The said Job Young covenants and agrees faithfully, truly and diligently to write [or work] for, and act as the clerk [or journeyman] of him the said David Irwin, from the day of the date hereof, for and during the space of one whole year, if so long both parties live, without absenting himself from the same; during which time he the said Job Young will resort to the said David Irwin's office [or shop] in Westchester, and there attend, and do and perform the clerkship [or work] aforesaid, without revealing any of the secrets of the said David Irwin, his occupation or business. In consideration of which service so to be performed, he the said David Irwin covenants and agrees to allow and pay to the said Job Young the sum of two hundred dollars, by four equal quarterly payments, or oftener if required. Provided, nevertheless, that when and as often as the said Job Young hath not writing [or work] sufficient to keep the said Job Young in employ, then and so often during such time, it shall be lawful for the said Job Young to do any other business for his own use and on his own account; but if it should happen that the said Job Young fall sick, or shall be absent from the office [or shop] of the said David Irwin, when he has employment for him, then such absent time shall be deducted, al-

lowed for and made up to the said David Irwin. And for the true performance of all and singular the covenants and agreements aforesaid, each of the said parties bindeth himself, his heirs, executors and administrators, unto the other, his executors, administrators and assigns, in the penal sum of five hundred dollars, firmly by these presents.

In witness whereof we have hereunto set our hands and seals the day and year above written.

DAVID IRWIN,
JOB YOUNG.

Sealed and delivered in presence of

Bill of Sale of Goods.

Know all men by these presents, That I, Allen Armstrong, of the city of Philadelphia, state of Pennsylvania, merchant, for and in consideration of the sum of eight hundred dollars, to me in hand paid by Benjamin Davis, of the same place, at and before the ensealing and delivery of these presents, the receipt whereof is hereby acknowledged, have bargained, sold and delivered, and by these presents do bargain, sell and deliver unto the said Benjamin Davis, [*here insert the goods sold*] to have and to hold the said [*goods*] unto the said Benjamin Davis, his executors, administrators and assigns, to his and their own proper use, benefit and behoof for ever. And I, the said Allen Armstrong, my heirs, executors and administrators, the said bargained premises unto the said Benjamin Davis, his executors, administrators and assigns, from and against all person and persons whomsoever shall and will warrant and forever defend by these presents.

In witness whereof I have hereunto set my hand and seal, this fifth day of January, one thousand eight hundred and thirty-six.

ALLEN ARMSTRONG.

Sealed and delivered in presence of

ANOTHER—*A Bill of Sale of Goods.*

Know all men by these presents, That I, Jacob Goodman, of Heidelberg township, Berks county, state of Pennsylvania, merchant, for and in consideration of the sum of five hundred dollars, to me in hand paid by Francis Polm, of the same

place, at or before the sealing and delivery of these presents, the receipt whereof I do hereby acknowledge, have granted, bargained and sold, and by these presents do grant, bargain and sell unto the said Francis Polm, his executors, administrators and assigns, all the goods, household stuff, implements and furniture, and all other goods and chattels whatsoever mentioned and expressed in the schedule hereunto annexed. [*Or thus*, hereinafter particularly mentioned, that is to say, *one bureau*, &c.] now remaining and being in the house of Jacob Goodman: to have and to hold all and singular the said goods, household stuff and furniture, and other the premises above bargained and sold, or mentioned or intended so to be, to the said Francis Polm, his executors, administrators and assigns forever. And I, the said Jacob Goodman, for myself, my heirs, executors and administrators, all and singular the said goods, &c. unto the said Francis Polm, his executors, administrators and assigns, against me the said Jacob Goodman, my executors and administrators, and against all and every other person and persons whomsoever shall and will warrant and forever defend by these presents. Of all and singular of which said goods, &c. I the said Jacob Goodman, have put the said Francis Polm in full possession, by delivering to him the said Francis Polm one silver spoon, at the sealing and delivery of these presents, in the name of the whole premises hereby bargained and sold, or mentioned or intended so to be, unto him the said Francis Polm, as aforesaid.

In witness whereof I have hereunto set my hand and seal, the first day of February, one thousand eight hundred and thirty-six.

JACOB GOODMAN.

Sealed and delivered in presence of

Letter of Attorney.

Know all men by these presents, That I, Jesse Denny, of Newlin township, Chester county, in the state of Pennsylvania, merchant, have made, constituted and appointed, and by these presents do make, constitute and appoint, and in my place and stead put and depute my son Samuel Denny, of the borough of Oxford, of the county and state aforesaid, painter,

my true and lawful attorney for me and in my name, and for my use, to ask, demand, sue for, recover and receive all such sum or sums of money, debts, goods, wares, dues, accounts and other demands whatsoever, which are or may be due, owing, payable and belonging to me, or detained from me, by any manner of ways or means whatsoever, or in whose hands soever the same may be found; [and also to pay and discharge all sums of money, due and owing by me, to any person or persons whatsoever,] giving and granting unto my said attorney, by these presents, my full and whole power, strength and authority in and about the premises, to have, use and take all lawful ways and means in my name, and for the purposes aforesaid; and upon the receipt of any such debts, dues or sums of money, acquittances or other sufficient discharges for me and in my name to make, seal and deliver: and generally, all and every act or acts, thing or things, device and devices in the law, whatsoever needful and necessary to be done in and about the premises, for me and in my name to do, execute and perform as fully, largely and amply to all intents and purposes, as I myself might or could do if personally present; and attornies one or more under him, for the purpose aforesaid, to make and constitute and again to revoke at pleasure.—Hereby ratifying, allowing and holding for firm and effectual, all and whatsoever my said attorney shall lawfully do in and about the premises aforesaid by virtue hereof.

In witness whereof I have hereunto set my hand and seal, the first day of June, in the year of our Lord one thousand eight hundered and thirty-six.

Sealed and delivered in presence of

Chester county, ss.

On the 14th day of June, in the year of our Lord one thousand eight hundred and thirty-six, personally appeared before me the subscriber, one of the justices of the peace in and for said county, the above named Jesse Denny, and acknowledged the foregoing letter of attorney to be his act and deed.

Witness my hand and seal on the day and year above written.

JOHN WARNER.

Letter of Attorney—To receive Debts.

Know all men by these presents, That I, William Carey, of the city of Lancaster, state of Pennsylvania, chairmaker, (for divers good causes and considerations, me hereunto moving,) have made, ordained, authorised, constituted and appointed, and by these presents do make, ordain, authorise, constitute and appoint Joseph Neeld of the same place, my true and lawful attorney, (irrevocable) for me and in my name and to my use, (or to the use of him the said Joseph Neeld) to ask, demand, sue for, recover and receive of Samuel Coale, of Middletown township, state aforesaid, all and every sum and sums of money, debts and demands whatsoever, which now are due and owing unto me the said William Carey, by and from the said Samuel Coale; and in default of payment thereof, to have, use and take all lawful ways and means, in my name or otherwise, for the recovery thereof, by attachment, arrest, (distress) (re-entry) or otherwise, (and to compound and agree for the same,) and on receipt thereof, to make, seal and deliver acquittances or other sufficient discharges for the same, for me and in my name; and to do all lawful acts and things whatsoever concerning the premises, as fully in every respect as I myself might or could do if I were personally present, and an attorney or attornies under him for the purposes aforesaid, to make, and at his pleasure to revoke; hereby ratifying, allowing and confirming all and whatsoever my said attorney shall in my name lawfully do or cause to be done, in and about the premises, by virtue of these presents.

In witness whereof I have hereunto set my hand and seal, the first day of January, one thousand eight hundred and thirty-six.

WILLIAM CAREY.

Sealed and delivered in presence of

Conditions of Public Vendue.

The conditions of the present public vendue, made and held this twentieth day of April, A. D. one thousand eight hundred and thirty-six, for the sale of a messuage and tract of about sixty-five acres of Land, with the appurtenances, situate in Tredyffrin township, Chester county, now in the

tenure of Henry Greatrake, are as follow: The highest and best bidder to be the buyer; and if any dispute arise as to the last and best bidder, the property shall be put up at a former bidding. That the purchaser shall, within one hour after the property is struck off to him, pay down the sum of two hundred dollars, lawful money of Pennsylvania, or give his note of hand, payable ten days after date; and to pay the further sum of two thousand dollars, like money aforesaid, on the first day of April next, and give satisfactory security for the payment of the residue, in two equal annual payments thereafter, with lawful interest from the said first day of April next, payable annually. On the purchaser performing as aforesaid, the subscriber hereby obligates and binds himself, his heirs, executors, administrators or assigns, that he or either of them shall and will, at the proper cost and charges of such purchaser, his heirs or assigns, sign, seal and deliver, or cause so to be done, a good and sufficient deed, in fee simple, for conveying and assuring the said premises with the appurtenances, unto the said purchaser, his heirs or assigns; and shall and will on the first day of April next, (the purchaser having performed as aforesaid,) give a quiet and peaceable possession of said premises to the purchaser, his heirs or assigns. [Here make the necessary reserves, such as grain in the ground, &c.] And for the true performance of all and singular the covenants aforesaid, I, Edmund Jones, do for myself, my heirs, executors, administrators and assigns, hereby obligate and bind myself to comply with the aforesaid conditions. In witness whereof, I have hereunto set my hand and seal, the day and year first above written.

EDMUND JONES.

Signed and sealed in the presence of

Sale of Goods and Chattels.

The conditions of this present public vendue, held this twentieth day of March, A. D. one thousand eight hundred and thirty-six, for the sale of the goods and chattels of the subscriber are as follow:—The highest and best bidder to be the buyer; any person buying to the amount of four dollars, and under, to pay cash, and for all sums exceeding, the purchasers to have four months' credit from this date, by giving

their notes of hand, [before the removal of the goods,] with approved security, if required.

WILLIAM FLEMING.

Mortgage.

This indenture, made the first day of March, in the year of our Lord one thousand eight hundred and thirty-six, between Eli Kling, of Richland township, Bucks county, and state of Pennsylvania, of the one part, and John Downing, of Tinicum township, county and state aforesaid, of the other part, witnesseth, That whereas the said Eli Kling, in and by a certain bond or obligation, duly executed, bearing even date herewith, doth stand bound unto the said John Downing in the penal sum of two thousand dollars, lawful money of the state of Pennsylvania, conditioned for the payment of one thousand dollars, lawful money aforesaid, on the first day of April next ensuing the date hereof, with lawful interest for the same, as in and by the said recited obligation and condition thereof more fully appears. Now this indenture witnesseth, that the said Eli Kling, as well for and in consideration of the aforesaid debt or sum of one thousand dollars, and for the better securing the payment thereof, with interest till paid, unto the said John Downing, his executors, administrators and assigns, in discharge of the said recited obligation, as of the further sum of one dollar to him in hand paid by the said John Downing, at the time of the execution hereof, the receipt whereof is hereby acknowledged, hath granted, bargained, sold, released and confirmed, and by these presents doth grant, bargain, sell, release and confirm unto the said John Downing, his executors, administrators and assigns, all that, &c. [*Here insert the premises.*]

Together with all and singular the buildings, improvements, ways, waters, water-courses, rights, liberties, privileges, hereditaments and appurtenances whatsoever, unto the said hereby granted premises belonging or in any wise appertaining, and the reversions and remainders thereof; to have and to hold the said messuage, &c. hereditaments and premises hereby granted or mentioned, or intended so to be, with the appurtenances, unto the said John Downing, his heirs and assigns, to the only proper use and behoof of the said John Downing, his heirs and assigns, forever. Provided always,

nevertheless, that if the said Eli Kling, his heirs, executors, administrators or assigns, shall and do well and truly pay or cause to be paid, unto the said John Downing, his executors, administrators or assigns, the aforesaid debt or sum of one thousand dollars, on the day and time herein before mentioned and appointed, together with lawful interest for the same, according to the condition of the said recited obligation, without fraud or further delay, and without deduction, defalcation or abatement to be made for, or in respect of taxes, charges or assessments, whatsoever, then, as well this present indenture and the estate hereby granted, as the said recited obligation, shall become void and of no effect, any thing herein before contained to the contrary in any wise notwithstanding. In witness whereof, the said parties have hereunto set their hands and seals, the day and year above written.

Sealed and delivered in presence of

Acknowledgment of a Mortgage.

The first day of March, A. D. one thousand eight hundred and thirty-six, before me, the subscriber, one of the justices of the peace in and for the county of Bucks, came the above named Eli Kling, and acknowledged the above indenture to be his act and deed, and desired the same might be recorded as such.

Witness my hand and seal,

ISAAC HICKS, J. P.

DEED—Common Form.

THIS INDENTURE, made the first day of March, in the year of our Lord one thousand eight hundred and thirty-six, by and between William Mulberry, of the township of Sadsbury, in the county of Chester, and state of Pennsylvania, farmer, and Sarah his wife, of the one part, and Gerard G. Leopold, of the borough of Harrisburg, in the county of Dauphin, and state aforesaid, nursery-man, of the other part, witnesseth, that he the said William Mulberry and Sarah his wife, for and in consideration of the sum of four thousand dollars, to them in hand paid by the said Gerard G. Leopold, at and before the sealing and delivery hereof, the receipt and payment whereof

they do hereby acknowledge, and thereof do forever acquit and discharge the said Gerard G. Leopold, his heirs, executors and administrators, by these presents, have granted, bargained and sold, and by these presents do grant, bargain and sell unto the said Gerard G. Leopold, and to his heirs and assigns, a certain Tract of Land, situate in Sadsbury township, and county of Chester aforesaid, bounded as follows, viz: Beginning at an Italian mulberry tree, thence by land of Jason M. Mahan, south five degrees west one hundred and twenty-six perches, to a sugar maple tree; thence by land of Job Pyle, north eighty-five degrees west, one hundred and thirty-four perches, to an ailanthus tree; thence by land of James Latta, north five degrees east one hundred and twenty-six perches, to a linden tree; thence by land of John Yates, south eighty-five degrees east one hundred and thirty-four perches, to the place of beginning; containing one hundred and five acres and eighty-four perches, be the same more or less; it being the same premises which Job Pyle and Mary his wife, by indenture bearing date the first day of May, Anno Domini one thousand eight hundred and thirty-two, for the consideration therein mentioned, did grant and confirm unto the said William Mulberry, (party hereto,) and to his heirs and assigns forever, as in and by the said in part recited indenture, recorded in the office for recording of deeds, at Westchester, in and for the county of Chester, in Book D, vol. 9, page 213, relation being thereunto had more fully appears: together with all and singular the rights, privileges, hereditaments and appurtenances thereunto belonging, and the remainders, rents, issues and profits thereof; and also all the estate, right, title, interest, property, claim and demand, whatsoever, of them the said William Mulberry and Sarah his wife, in law or equity or otherwise howsoever, of, in, to or out of the same or any part thereof; to have and to hold the said demised premises, hereby granted and sold, with the appurtenances, unto the said Gerard G. Leopold and his heirs and assigns forever. And the said William Mulberry and Sarah his wife, for themselves, their heirs, executors and administrators, do hereby covenant, promise, grant and agree, to and with the said Gerard G. Leopold, his heirs and assigns, by these presents, that they the said William Mulberry and Sarah his wife, the above described premises hereby granted and sold, with the appurtenances, unto the said

Gerard G. Leopold, his heirs and assigns, against the said William Mulberry and Sarah his wife, and their heirs, and against every other person and persons lawfully claiming or to claim the same or any part thereof, shall and will warrant and forever defend by these presents.

In testimony whereof the said William Mulberry and Sarah his wife have hereunto set their hands and seals, the day and year first above written.

WILLIAM MULBERRY, {L. S.}

SARAH MULBERRY. {L. S.}

Sealed and delivered in the presence of
William W. Eachus,
Philip Hathaway.

Receipt.

Received, on the day of the date of the above written indenture, of and from the within named Gerard G. Leopold, Four Thousand Dollars, being in full of the consideration therein mentioned.

WILLIAM MULBERRY,
SARAH MULBERRY.

Witnesses present.
William W. Eachus,
Philip Hathaway.

Acknowledgment of a Deed.

Chester county, ss.

The first day of March, in the year of our Lord one thousand eight hundred and thirty-six, personally appeared before me the subscriber, one of the justices of the peace in and for the county aforesaid, the above named William Mulberry and Sarah his wife, and acknowledged the above written indenture to be their, and each of their act and deed, and desired the same as such might be recorded according to law. She, the said Sarah, being of lawful age; separate and apart from her said husband, by me examined, and the full contents of the said indenture unto her made known. Whereupon she did declare that she did voluntarily, and of

her free will and accord, seal, and as her act and deed, deliver the same without any concern or compulsion of her said husband whatever.

Witness my hand and seal,

GEORGE W. PARKE, J. P.

The form of a Will, with the devise of a Real Estate, Leasehold, &c.

The last Will and Testament of Caleb Taylor, of Tinicum township, Bucks county. I, Caleb Taylor, considering the uncertainty of this mortal life, and being of sound mind and memory, (blessed be Almighty God for the same,) do make and publish this my last will and testament, in manner and form following, (that is to say,) First, I give and bequeath unto my beloved wife, Mary Taylor, the sum of two thousand dollars. *Item*, I give and bequeath to my eldest son, Samuel Taylor, the sum of nine hundred dollars: *Item*, I give and bequeath unto my two younger sons, John Taylor and Peter Taylor, the sum of seven hundred dollars each. *Item*, I give and bequeath to my daughter-in-law, Mary Watson, single woman, the sum of six hundred dollars, which said several legacies, or sums of money, I will and order to be paid to the said respective legatees, within one year after my decease. I further give and devise to my said eldest son, Samuel Taylor, his heirs and assigns, all that messuage or tenement, situate, lying and being in Tinicum township, and county aforesaid, together with all my other freehold estate whatsoever, to hold to him the said Samuel Taylor, his heirs and assigns, for ever. And I hereby give and bequeath to my said younger sons, John Taylor and Peter Taylor, all my leasehold estate, of and in all those messuages, or tenements, with the appurtenances, situate in Newtown township, county aforesaid, equally to be divided between them. And lastly, as to all the rest, residue and remainder of my personal estate, goods and chattels, of what kind and nature soever, I give and bequeath the same to my said beloved wife, Mary Taylor, whom I hereby appoint sole executrix of this my last will and testament; hereby revoking all former wills by me made. In witness whereof, I have hereunto set my hand and seal, the first day of January, in the year of our Lord, one thousand eight hundred and thirty-six.

CALEB TAYLOR.

Signed, sealed, published and declared, by the above named Caleb Taylor,* to be his last will and testament, in the presence of us; who, at his request and in his presence, have subscribed our names as witnesses thereunto.

JAMES SMITH,
THOMAS WILLIAMS,
HENRY RIETH.

* Caleb Taylor should say, in the presence of the witnesses when he signs this—"I sign and publish this as my last will and testament."

Common Bond of Arbitration.

Know all men by these presents, that I, Aaron Wiley, of the township of Swatara, in the county of Dauphin, gentleman, am held and firmly bound to John Thomas, of the township and county aforesaid, yeoman, in the sum of five hundred dollars, of good and lawful money of the United States, to be paid to the said John Thomas, or to his certain attorney, executors, administrators or assigns, for which payment to be well and faithfully made, I bind myself, my heirs, executors and administrators, firmly by these presents. Sealed with my seal—dated the first day of August, in the year of our Lord one thousand eight hundred and thirty-six.

The condition of this obligation is such, that if the above bounden Aaron Wiley, his heirs, executors and administrators, on his or their parts and behalfs, shall and do in all things well and truly stand to, obey, abide by, perform, fulfil and keep the award, order, arbitrement and final determination of Job Ward, James Fox and David Rule, of the township and county aforesaid, arbitrators, indifferently elected and named, as well on the part and behalf of the above bounden Aaron Wiley, as of the above named John Thomas, to arbitrate, award, order, judge and determine of and concerning all and all manner of action and actions, cause and causes of action, suits, bills, bonds, specialties, judgments, executions, extents, quarrels, controversies, trespasses, damages and demands whatsoever, at any time heretofore had, made, moved, brought, commenced, sued, prosecuted, done, suffered, committed or depending by and between the said parties, so as the said award be made in writing, under the hands of the said Job Ward, James Fox and David Rule, or any two of

them, and ready to be delivered to the said parties in difference, or such of them as shall desire the same, on or before the first day of June, one thousand eight hundred and thirty-six, then this obligation to be void, or else to remain in full force.

Award—By three Arbitrators.

To all to whom this present writing of award indented shall come, we, Job Ward, James Fox and David Rule, send greeting: Whereas, divers controversies and debates have been and yet are depending between Aaron Wiley and John Thomas, for the appeasing and determining whereof, the said parties have submitted themselves, and are become bound each to the other by their several obligations, bearing date the first day of April, one thousand eight hundred and thirty-six, in the sum of five hundred dollars, with conditions thereunder written for the performance of the award, arbitrement, determination and judgment of us, the said Job Ward, James Fox and David Rule, arbitrators indifferently elected and chosen, as well on the part and behalf of the said Aaron Wiley, as on the part and behalf of the said John Thomas, to award, arbitrate, determine and judge of and concerning all and all manner of actions, suits, judgments, executions, accounts, quarrels, controversies, trespasses, damages and demands whatsoever had, made, moved, commenced or depending between the said Aaron Wiley and John Thomas, so as the said award, determination and judgment of us, the said Job Ward, James Fox and David Rule, of and concerning the premises, be made and put in writing, under our hands and seals, on or before the first day of April, as by the said obligations and conditions thereof, doth more fully appear. Now know ye, that we the said Job Ward, James Fox and David Rule, arbitrators as aforesaid, taking upon us the charge and burden of the said award and arbitrement, and having heard and understood the sayings and allegations of both parties, concerning the premises, and being minded to settle unity and friendship between them, concerning the same, do thereupon make and put in writing this our award, arbitration and judgment between the said parties, for and concerning the premises, in manner and form following, that is to say: First, we do award, arbitrate, and determine by these presents,

that the said Aaron Wiley, his heirs, executors or administrators, do and shall pay or cause to be paid unto the said John Thomas, the sum of three hundred and forty dollars and fifty cents, and that upon payment thereof, each of them, the said John Thomas and Aaron Wiley, shall seal and subscribe, and as his several act and deed, deliver unto the other of them a general release in writing, of all matters, actions, suits, cause and causes of action, bonds, bills, covenants, controversies and demands whatsoever, either of them hath, may, might, or in any wise ought to have, against the other of them, by reason of the matters aforesaid, or by reason or means of any matter, cause or thing whatsoever, from the beginning of the world unto the day of the date of the said obligation: And for the better attestation and confirmation of this award, we the said arbitrators have hereunto set our hands and seals, the first day of June, in the year of our Lord one thousand eight hundred and thirty-six.

JOB WARD,
JAMES FOX,
DAVID RULE.

Petition for laying out a Road.

To the honorable the judges of the Court of Common Pleas of the county of Lancaster, now composing a Court of Quarter Sessions of the Peace, in and for the said county.

The petition of divers inhabitants of the township of Leacock, in the said county, humbly sheweth:

That your petitioners labor under great inconveniences for want of a road or highway, to lead from ——— to ———. Your petitioners therefore humbly pray the court to appoint proper persons to view and lay out the same according to law. And they will pray, &c.

☞ There must be no intermediate points made in the road prayed for.

RETURN.

To the honorable the Judges within named.

We, the persons appointed by the within order of court, to view and lay out the road therein mentioned, do report, that

in pursuance of the said order, we have viewed and laid out, and do return for public [or private] use, the following road, to wit: Beginning, &c. [here describe the courses and distances in letters, not figures, with references to the improvements through which it passes,] a plot or draft whereof is hereunto annexed. Witness our hands the first day of July, one thousand eight hundred and thirty-six.

☞ At least five of the viewers must view the ground, and any four of the actual viewers may lay out the road.

Another.

We, the subscribers, do report, that in pursuance of the within order of court, we have viewed the place where the road within mentioned is requested, and are of opinion that there is no occasion to lay out the same. Witness our hands, &c.

Petition for review of a Road.

To the honorable the judges of the Court of Common Pleas of the county of Lancaster, now composing a Court of Quarter Sessions of the Peace, in and for the said county.

The petition of divers inhabitants of the township of Cocalico, in the said county, humbly sheweth:

That a road hath been lately laid out, by order of the court, from ———, &c. which road, if confirmed by the court, will be very injurious to your petitioners, and burthensome to the inhabitants of the township through which the same runs. Your petitioners therefore pray your honors to appoint proper persons to review the said road and parts adjacent, and make report to the court according to law. And they will pray, &c.

REPORT.

To the honorable the Judges within named.

We, the persons appointed to review the road within mentioned, and parts adjacent, do report: That in pursuance of the said order we did review the same, and have laid out for public use, the following road, to wit: Beginning, &c, [or, after 'same,' say 'and in our opinion there is no occasion for such a road.'] Witness our hands, &c.

Petition for vacating a Road.

To the honorable, &c. The petition of, &c. Humbly sheweth:

That a road has been long since laid out from, &c.———, which road, [or part of which road, beginning, &c.] your petitioners humbly conceive is now become useless, inconvenient and burthensome to the inhabitants thereabouts.—Your petitioners therefore humbly pray your honors, that the said road may be vacated, agreeably to the act of general assembly, in such case made and provided. And they will ever pray, &c.

REPORT.

To the honorable, &c.

We, the subscribers, appointed by the within order of court, to view the road therein mentioned, do report, That in pursuance of said order, we have viewed the said road, and that the same is, in our opinion, useless, inconvenient, and burthensome, [or, that, in our opinion, there is no cause for vacating the same.] Witness our hands this first day of June, one thousand eight hundred and thirty-six.

Petition for valuing Lands.

To the honorable, &c. The petition of, &c. Humbly sheweth:

That a public road or highway was lately laid out and opened, by order of this court, from ———; which road is laid out and opened through the land of your petitioners. Your petitioners, therefore, humbly pray your honors to appoint proper persons to view and adjudge the value of so much of their lands, respectively, as is or may be taken up for the use of the said road. And they will pray, &c.

REPORT.

To the honorable, &c.

We, the subscribers, appointed by the within order of court, to view and adjudge the value of so much of the lands of C. D. as are taken up by the road therein mentioned, do report, That in pursuance of the said order, we have viewed the lands taken up by the road therein mentioned, and do value and

adjudge the loss thereby occasioned to the within named C. D. at the sum of ——— dollars; and the loss thereby occasioned to E. F. at the sum of ——— dollars, respectively. Witness our hands the first day of April, one thousand eight hundred and thirty-six.

Another.

We, the subscribers, within appointed to view and assess the damages sustained by the petitioner, C. D. by reason of the premises in the within order mentioned, do report, that, having been previously sworn and affirmed, according to law, we did view the lot through which the within mentioned road passes, and that upon due consideration, as well of the advantages as disadvantages arising to the petitioner, we are of opinion, that he has received damage to the amount of ——— dollars, and we do accordingly assess the same. Witness our hands, &c.

A general release from one to one.

Know all men by these presents, That I, Amos Vansant, of Vincent township, Chester county, have remised, released and forever discharged, and by these presents do, for me, my heirs, executors and administrators, remise, release and forever discharge Enos Philips, of Schuylkill township, county aforesaid, his heirs, executors and administrators, of and for all, and all manner of actions, causes of action, suits, debts, dues, sums of money, accounts, reckonings, bonds, bills, specialties, covenants, contracts, controversies, agreements, promises, variances, damages, judgments, extents, executions, claims and demands whatsoever, in law and equity, which against the said Enos Philips, I ever had, now have, or which I, my heirs, executors or administrators, hereafter can, shall, or may have, for, upon, or by reason of any matter, cause or thing whatsoever, from the beginning of the world to the day of the date of these presents. In witness whereof I have hereunto set my hand and seal, the first day of July, one thousand eight hundred and thirty-six.

AMOS VANSANT.

Sealed and delivered in presence of

Release of a Legacy.

Know all men by these presents, That whereas Hiram Boyer, of Whitemarsh township, Montgomery county, by his last will and testament in writing, bearing date the first day of January, one thousand eight hundred and thirty-six, did, among other legacies therein contained, give and bequeath unto me, Willis Pim, of the township of Upper Merion, and county aforesaid, the sum or legacy of three thousand dollars, and of his said will made and constituted Jesse Trewig sole executor, as in and by the said will may appear. Now know ye, that I, the said Willis Pim, do hereby confess and acknowledge that I have had and received of and from the said Jesse Trewig, the legacy or sum of three thousand dollars, so as aforesaid given and bequeathed unto me, by the said Hiram Boyer. And therefore I do by these presents acquit, release and discharge the said Jesse Trewig, of and from all legacies, dues, duties and demands, whatsoever, which I, my executors or administrators, may have, claim, challenge or demand, of or against the said Jesse Trewig, his executors or administrators, by virtue of the said last will and testament of or out of the estate of the said Hiram Boyer, deceased, as aforesaid.

In witness whereof I have hereunto set my hand and seal, the first day of June, in the year of our Lord one thousand eight hundred and thirty-six.

WILLIS PIM.

Sealed and delivered in presence of

Release to a Guardian.

Know all men by these presents, That John Marple, son and heir of Lot Marple, deceased, hath remised, released and forever quit-claimed, and by these presents doth remise, release, and forever quit claim, unto Thomas C. James, of New Britain township, Bucks county, his guardian, all and all manner of actions, suits, reckonings, accounts, debts, dues and demands whatsoever, which he, the said John Marple, ever had, now hath, or which he, his executors or administrators, at any time hereafter, can or may have, claim or demand, against the said Thomas C. James, his executors or administrators, for touching or concerning the management and disposition of any of the lands, tenements or heredita-

ments of the said John Marple, situate in Doylestown township, and county aforesaid, or any part thereof, or for or by reason of any money, rents or other profits by him received, out of the same, or any payments made thereof, during the minority of the said John Marple, or by reason of any matter, cause or thing whatsoever, from the beginning of the world to the day of the date hereof.

In witness whereof I have hereunto set my hand and seal, the first day of January, in the year of our Lord one thousand eight hundred and thirty-six.

JOHN MARPLE.

Sealed and delivered in presence of

Remarks.—A release must be by an instrument sealed; and the most beneficial release which a man can have, is one of all demands.

Where a person has a cause of action against several, either for a debt due, or a wrong done, and for which they are jointly and separately liable, it seems that a release to one is a release to all.

For Money received on a Purchase.

Know all men by these presents, That I, Philip Hathaway, of Moyamensing township, Philadelphia county, do hereby acknowledge myself, upon the day of the date hereof, to have received of Jesse James, of the township and county aforesaid, the sum of four hundred dollars, of lawful money of the state of Pennsylvania, being the last payment, and in full of fifteen hundred dollars, by him paid, as the consideration of the purchase of a certain plantation and tract of land, situate in Byberry township, and county aforesaid, by me, the said Philip Hathaway, sold and conveyed to the said Jesse James. And of the said whole sum of fifteen hundred dollars, and of every part and parcel thereof, I, the said Philip Hathaway, do by these presents, for me, my heirs, executors and administrators, acquit and discharge the said Jesse James, his heirs, executors and administrators, for ever.

Witness my hand this first day of January, in the year of our Lord one thousand eight hundred and thirty-six.

PHILIP HATHAWAY.

MENSURATION.

MENSURATION is the art of measuring, and consists of three parts, viz. lineal measure, (or, as it is commonly called, long or running measure,) superficial or square measure, and cubic or solid measure; for the denominations see pages 37, 39 and 46.

OF THE SQUARE.

A square is a plane superficies, having each of its opposite sides parallel and equal; and all its angles are right angles.

A side given, to find the area; or the area given, to find the length of a side.

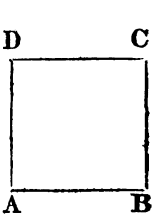
RULE.

1. Multiply a side by itself, and the product will be the superficial content, or area.

2. Extract the square root of the area, and this root will be the length of a side.

Examples.

1. What is the area of a square whose side AB is 37 perches?



37×37=1369 perches=8 A. 2 R. 9 P. Ans.

2. Required the side of a square field whose area is 10 A, 2 R. 1 P.

10 A. 2 R. 1 P.=1681 P.; and $\sqrt{1681}$=41 per. Ans.

3. How many square yards are in a floor 39 feet square? Ans. 169.

4. A square plantation contains 255 acres 4 perches—I wish to know the length of one of its sides. Ans. 202 P.

5. How many fields of 25 perches square may be made of one of 100 perches square? Ans. 16.

6. How many lots of 25 square perches may be made of a field 100 perches square? Ans. 400.

7. Required the area of one mile square.

Ans. 640 acres, or 1 section.

8. How many sections of land in a township five miles square? Ans. 25.

OF THE RECTANGULAR PARALLELOGRAM OR OBLONG.

A rectangular parallelogram, or oblong, is a plane superficies, having each of its opposite sides parallel, and all its angles are right angles.

The length and breadth given, to find the area; or the area and one side given, to find the length of the other side.

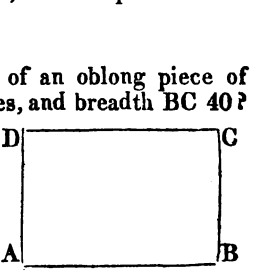
RULE.

1. Multiply the length by the breadth, and the product will be the area.

2. Divide the area by one of the sides, and the quotient will be the adjacent side.

Examples.

1. What is the superficial content of an oblong piece of ground, whose length AB is 60 perches, and breadth BC 40?



60×40=2400 per.=15 Acres. Ans.

2. Purchased a field of an oblong form, 40 perches in breadth, containing 25 acres—I wish to know the length.

25 acres=4000 perches; and 4000÷40=100. Ans.

3. What is the superficial content of an oblong, whose length is 32 and breadth 30 perches? Ans. 6 acres.

4. Required the breadth of a field whose length is 95 perches, and contains 19 acres. Ans. 32 perches.

5. What is the length of a board that contains 24 square feet, and is 1½ feet broad? Ans. 16 feet.

6. A board contains 30 square feet, and is 1¼ feet broad; if 5 feet in length be sawn off at one end, what will be the length of the remaining part? Ans. 19 feet.

7. Required the area of a field whose length is 35 perches, and breadth 20 perches. Ans. 4 A. 1 R. 20 P.

OF THE RIGHT ANGLED TRIANGLE.

A right angled triangle is a plane superficies, having one right angle: the side opposite the right angle is called the hypothenuse, the side on which the triangle stands is called the base, and the other side the perpendicular. The base and perpendicular are sometimes called the legs.

The legs given, to find the area and hypothenuse; or the area and one leg given, to find the other leg and hypothenuse.

RULE.

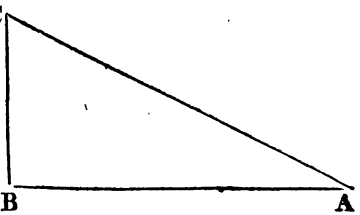
1. Multiply the base and perpendicular together, and half the product will be the area.

2. Divide the double area by the length of one leg, and the quotient will be the length of the other leg.

The hypothenuse may be found by the note at page 187.

Examples.

1. The base AB of a right angled triangle is 60, and perpendicular BC 32—Required the area, and hypothenuse AC.



$60 \times 32 = 1920$;
and $1920 \div 2 = 960 =$ Area.
$60^2 \times 32^2 = 3600 + 1024 = 4624$.
and $\sqrt{4624} = 68 =$ hypothenuse.

2. The area of a triangular field is 600 perches, and the base 50—I wish to know the length of the perpendicular and hypothenuse.

$600 \times 2 = 1200 =$ double area,
and $1200 \div 50 = 24 =$ perpendicular.
$50^2 + 24^2 = 2500 + 576 = 3076$,
and $\sqrt{3076} = 55.461$ Answer.

3. What is the area and hypothenuse of a triangle whose base is 64 and perpendicular 47 perches?

Ans. Area, 9 A. 1 R. 24 P. Hypothenuse, 54.845.

4. Required the area and base of a triangle whose perpendicular is 71 perches, and hypothenuse 2521 perches.

Ans. Area 559 A. 20 P. Base 2520 perches.

Note.—When the hypothenuse and one leg are given, if you multiply their sum by their difference, the product will be the square of the other leg.

5. What is the base of a triangle whose hypothenuse is 45 and perpendicular 27?

$45+27=72$ sum
$45-27=18$ difference

1296 product; and $\sqrt{1296}=36$ Answer.

6. The hypothenuse of a triangle is 261, and the base 189; required the perpendicular. Ans. 180.

Note.—When the area and hypothenuse are given, raise the hypothenuse to the 4th power; deduct 16 times the square of the area from this power, and extract the square root of the remainder, one half this root deducted from half the square of the hypothenuse, will give the square of the shorter leg, and if added thereto will give the square of the longer leg.

7. The area of a triangle is 84, and the hypothenuse 25—Required the other sides.

$25^4=390625$
$84^2\times16=112896$

277729, and $\sqrt{277729}=527$, and $527\div2=263\frac{1}{2}$
$25^2=625$, and $625\div2=312\frac{1}{2}$
$312\frac{1}{2}-263\frac{1}{2}=49$, and $\sqrt{49}=7$ shorter leg
$312\frac{1}{2}+263\frac{1}{2}=576$, and $\sqrt{576}=24$ longer leg } Ans.

8. The area of a triangle is 5280, and the hypothenuse 146; required the other sides. Ans. 110 and 96.

To find the area of any triangle, having the three sides given.

RULE.

Add together the three sides and take half the sum, deduct each of the several sides from that half sum, then multiply that half sum and the three differences continually together, and extract the square root of the product, which will be the area of the required triangle.

Examples.

1. The sides of a triangle are as follow, viz. AB 90, BC 80 and AC 70—Required the area.

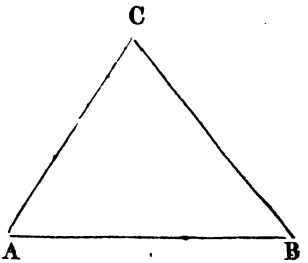
$$\left\{\begin{array}{c|c} 90 & 30 \\ 80 & 40 \\ 70 & 50 \end{array}\right\} \text{differences.}$$

2)240

120 half sum.

$120\times30\times40\times50=7200000$

and $\sqrt{7200000}=268.328$ Ans.



2. The sides of a triangle are 189, 170 and 89—What is the area? Ans. 7560.

3. What is the area of a triangle whose sides are 48, 60 and 72 perches? Ans. 8 A. 3 R. 28 P.+

4. The sides of a triangular garden are 8, 10 and 12 perches—Required the area. Ans. 39.68 perches +

OF THE TRAPEZIUM.

A trapezium is a plane superficies, bounded by four straight lines, no two of them being parallel to each other. A line connecting the opposite angles is called a diagonal.

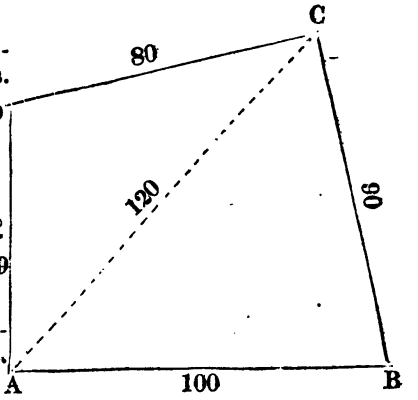
The four sides and diagonal given, to find the area.

RULE.

Divide the trapezium into two triangles, by drawing a diagonal across it, then find the area of each triangle separately, as before taught, and the sum of these will be the area of the trapezium.

Examples.

1. Required the area of a four sided field, whose south side is 100 perches, east side 90 perches, north side 80 perches, and west side 70 perches; the diagonal from north-east to south-west being 120 perches.



Sides { 80 | 55 } differences.
Sides { 120 | 15 }
Sides { 70 | 65 }

2)270

135 half sum.

135×55×15×65=
7239375
& √7239375=2690.619
area of ADC.

Sides { 120 | 35 } differences.
Sides { 90 | 65 }
Sides { 100 | 55 }

2)310

155 half sum.

155×35×65×55 = 19394375
and √19394375=4403.904 area of ABC.
2690.619 area of ADC.

4,0)709,4.523 area of ABCD.

4)177-14.523

44 A. 1 R. 14.523 P. Answer.

Note.—Irregular figures are such as have more than four sides, which, as well as their angles, are unequal. The superficial content of all such figures may be found by dividing them into trapeziums and triangles, by lines drawn from one angle to another, calculating these separately, as before taught, and adding all the areas together.

OF REGULAR POLYGONS.

A regular polygon is a plane figure, having all its sides and angles equal.

To find the superficial contents, having a side and perpendicular let fall from the centre to the middle of one of its sides given.

RULE 1.

Multiply the sum of the sides by half the perpendicular; or multiply the whole perpendicular by half the sum of the sides, the product will be the area or superficial content.

Examples.

1. Required the area of an octagon, whose side is 4.9705, and perpendicular 6.

4.9705×8=39.764, and 39.764÷2=19.882 = half sum of the sides.

19.882×6=119.292 Answer.

2. Required the superficial content of a hexagon, whose side is 20 and perpendicular 17.320508. Ans. 103.923048.

A TABLE

For more readily finding the area and perpendicular of a regular Polygon.

No. of sides.	Names.	Areas. The side 1.	Perpendiculars. The side 1.
3	Trigon,	.433013	.2886751
4	Tetragon,	1.000000	.5000000
5	Pentagon,	1.720477	.6881910
6	Hexagon,	2.598076	.8660254
7	Heptagon,	3.633912	1.0382617
8	Octagon,	4.828427	1.2071068
9	Nonagon,	6.181824	1.3737387
10	Decagon,	7.694209	1.5388418
11	Undecagon,	9.365640	1.7028437
12	Duodecagon,	11.196152	1.8660254

RULE 2.

Multiply the tabular area by the square of the side, and the product will be the area of the polygon; or multiply the tabular perpendicular by the side of the polygon, the product will be the perpendicular of the polygon; then proceed by Rule 1.

Examples.

1. Required the area of a heptagon, whose side is 400.

$400^2 = 160000$, and $3.633912 \times 160000 = 581425.92$ Ans.

2. Required the area of a pentagon whose side is 12.

$.688191 \times 12 = 8.258292$ = perpendicular of the polygon.
$12 \times 5 = 60$, and $60 \div 2 =$ half sum of the sides.
$8.258292 \times 30 = 247.74876$ Answer.

3. What is the area of a hexagon whose side is 10?

Ans. 259.8076.

OF THE CIRCLE.

A circle is a plane superficies, bounded by one line called the circumference, which is every where equidistant from a point within it, which is called the centre.

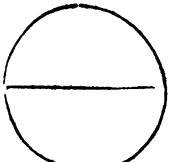
The circumference given, to find the diameter; or the diameter given, to find the circumference.

RULE.

1. As 7 is to the diameter, so is 22 to the circumference.
   Or, As 113 is to the diameter, so is 355 to the circumference.
   Or, As 1 is to the diameter, so is 3.1416 to the circumference.
2. As 22 is to the circumference, so is 7 to the diameter.
   Or, As 355 is to the circumference, so is 113 to the diameter.
   Or, As 3.1416 is to the circumference, so is 1 to the diameter.

Examples.

1. If the diameter of a circle be 31.8309, what is the circumference?



As 1 : 31.8309 :: 3.1416 : 100 Ans.

2. If the circumference of a circle be 29, what is the diameter?

As 3.1416 : 29 :: 1 : 9.23 Answer.

3. If the diameter of the earth be 7958 miles, (as it is very nearly,) what is the circumference, supposing it to be exactly round? Ans. 25000.8528 miles.

The diameter or circumference of a circle given, to find the area; or the area given, to find the diameter or circumference.

RULE.

1. Multiply half the circumference by half the diameter, and the product will be the area.

Or multiply the square of the diameter by .7854, and the product will be the area.

Or multiply the square of the circumference by .07958, and the product will be the area.

2. Divide the area by .7854, and the square root of the quotient will be the diameter.

Or, divide the area by .07958, and the square root of the quotient will be the circumference.

Examples.

1. If the diameter of a circle be 12, what is the area?

12×12=144, and 144×.7854=113.0976 Answer.

2. If the circumference of a circle be 12, what is the area?

12×12=144, and 144×.07958=11.45952 Answer.

3. If I drive a stake in my meadow, and fasten my horse to it by a rope of such a length that he may graze exactly half an acre, how long must the rope be?

Ans. 27.75 yards +

To find the area of an oval or ellipsis.

RULE.

Multiply the product of the two diameters by .7854, and this last product will be the area.

Examples.

1. Required the area of an elliptical fish pond whose diameters are 12 and 10.6 yards.

12×10.6=127.2, and 127.2×.7854=100 sq. yds. Ans.

2. What is the area of an ellipsis whose diameters are 12 and 9? Ans. 84.8232.

To find the side of a square piece of timber, that may be sawn or hewn from a round piece.

RULE.

Extract the square root of half the square of the diameter.

Or, multiply the girth or circumference by 2, and divide the product by 9, the quotient will be the side of the square, near enough for common purposes.

Examples.

1. The girth of a tree is 5 ft. 7½ in., required the side of a square post that may be hewn from it.

5 ft. 7½ in.×2=11 ft. 3 in.
and 11 ft. 3 in.÷9=1 ft. 3 in. Answer.

2. What must be the girth of a piece of round timber that will hew 2 feet square? Ans. 9 feet.

3. I wish to cut a tree that will hew 15 inches square—What must be its circumference? Ans. 5 ft. 7½ in.

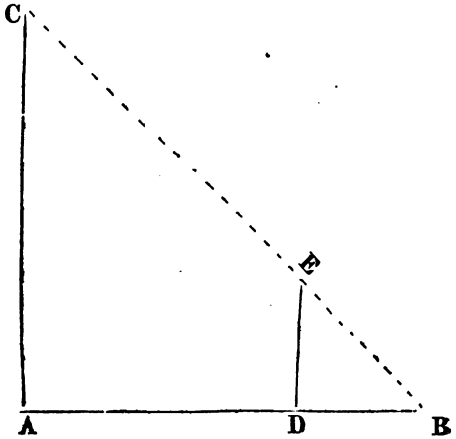
To measure the length of standing timber.

Provide a slight pole, about your height; measure off on your pole a length exactly equal to the height of your eye, and at this place cut a notch. Fix your pole opposite that side of the tree which affords the best view of the summit of its main stem, that is, up to that part which can be squared, or made into merchantable timber. Proceed to such a distance from the tree as to you may seem equal to its height; set the pole in the ground perpendicularly, up to the notch, and the station fixed upon must be level with the surface of the ground at the foot of the tree; lie down on your back, with the soles of your feet against the pole and your head directly from the tree; look over the top of the pole, and see where the sight strikes the tree; the pole may be removed nearer to or further from the tree, until the sight taken strikes that part of the tree up to which you calculate timber. Measure the distance from the tree to the foot of the pole, that added to the height of the pole from the notch, is the length of the timber. An allowance must, however, be made for the stump.

Example.

1. The distance from the foot of the tree to the pole is 31 feet; the height of the pole or eye 5 feet 6 inches, and an al-

lowance of 2 feet 6 inches is to be made for the height of the stump and waste in cutting—Required the length of merchantable timber.



ft.	in.	
31	0	= AD.
5	6	= DE = DB.
36	6	= AB = AC.
2	6	= stump and wastage.
34	0	= length of the timber.

2. From the foot of a tree to the pole measures 47 feet; height of the pole 5 feet, allowance for stump 2 feet—Required the length of the stick. Ans. 50 feet.

BOARD MEASURE.

Case I.

To find the superficial contents of boards.

Rule.

Multiply the length in feet by the width in inches, and divide the product by 12, the quotient will be the superficial content.

Note.—It frequently happens in measuring boards, that they are found to be wider at one end than the other; in which case take the width in the middle, if it be a straight edged board; or which results the same thing, add the width of the two ends together, and take half their sum for the mean breadth; but if it be not a straight edged board, and wider in some places than others, take the width in several places, and divide their sum by the number of breadths for the mean breadth; then proceed as before.

Examples.

1. What number of feet is there in a board 17 feet long and 11 inches broad?

17×11=187, and 187÷12=15 ft. 7 in. Answer.

2. Required the number of feet in a board 13 feet long, 16 inches wide at one end and 20 inches at the other.

16+20=36, and 36÷2=18 mean breadth.
13×18=234, and 234÷12=19 ft. 6 in. Ans.

3. An irregular board of 14 feet long measures at the ends 15 and 9 inches, the intermediate widths are 16, 13, 8, 6 and 10 inches—Required the number of feet in said board.

16+13+8+6+10+15+9=77,
and 77÷7=11 mean breadth.
14×11=154, and 154÷12=12 ft. 10 in. Ans.

Case II.

To find the superficial contents of any square piece of timber, scantling, plank, &c. having the length, breadth and thickness given.

Rule.

Multiply the length in feet by the breadth in inches, and divide by 12; the quotient will be the content in feet, at one inch thick, which multiply by the thickness in inches, the product will be the whole content.

If the piece of scantling, plank, &c. be wider at one end than the other, or be irregular, find the mean breadth as taught in Case I.

Examples.

1. Required the number of feet in a piece of timber 20 feet 6 inches long, 7 inches wide, and 5 inches thick.

20 ft. 6 in.×7=143½, and 143½÷12=11 ft. 11½ in.
11 ft. 11½×5=59 ft. 9½ in. Answer.

2. A piece of scantling measures 19 feet 4 inches long, 10 inches wide and 7 inches thick—How many feet does it contain, board measure? Ans. 112 ft. 4 in.

3. What is the content in board measure of 7 planks, measuring each 21 ft. 9 in. long, 21 inches wide and $2\frac{1}{2}$ inches thick? Ans. 666 ft. $1\frac{1}{2}$ in.

4. How many feet are there in a rafter, which measures 16 feet long, $4\frac{1}{2}$ inches wide at one end, and $3\frac{1}{2}$ at the other, and 3 inches thick? Ans. 16 ft.

5. Required the number of feet in 4 pieces of scantling, one measuring 9 ft. 5 in. long, and 7 inches by 5; another 10 feet 6 inches long, 6 by 4; a third 11 feet 2 inches long, $6\frac{1}{2}$ by $5\frac{1}{2}$, and a fourth 10 feet 3 inches long, 6 by 4.

Ans. 102 ft. 2 in. $9\frac{1}{2}$ "

Case III.

To find the superficial contents of a round piece of timber, when hewn or sawn square.

Rule.

Multiply half the square of the diameter in inches by the length in feet: divide the product by 12, and the quotient will be the superficial content.

Examples.

1. Required the superficial content of a round piece of timber, whose length is 25 feet, and its mean diameter 20 inches.

$20 \times 20 = 400$,

and $400 \div 2 = 200$ = half square of the diameter,

Then $200 \times 25 = 5000$, and $5000 \div 12 = 416$ ft. 4 in. Ans.

2. How many feet of square edged boards, one inch thick, including the saw gap, can be made from a log 16 feet long and 20 inches in diameter? Ans. 266 ft. 8 in.

SOLID BODIES.

Solid bodies are such as consist of length, breadth and thickness, as stone, timber, globes, &c.

Note.—In the common use of geometry, the term solid does not only apply to absolute density, as is understood regarding

the timber in a beam, but a chest or box, though empty, is considered a solid. If the object contains length, breadth and thickness, it is sufficient to constitute a solid.

OF A CUBE.

A cube is a square solid, comprehended under six geometrical squares, being in the form of a die.

To find the solidity.

RULE.

Multiply the side of the cube by itself, and that product again by the side; the last product will be the solidity.

Example.

1. A cellar is to be dug whose length, breadth and depth are each 11 feet 6 inches—How many solid feet does it contain, and what will it cost digging at 12½ cents per solid yard?

11 ft. 6 in. = 11.5 feet,
and 11.5×11.5×11.5 = 1520.875 feet. Answer.

	sq. yd.	sq. ft.		cts.		$	
As	1	: 1520.875	::	12½	:	7.041+	Ans.

OF A PARALLELOPIPEDON.

A parallelopipedon is a solid having six rectangular sides, every opposite pair of which are equal and parallel.

To find the solidity.

RULE.

Multiply the length by the breadth, and that product by the depth.

Examples.

1. Required the number of cords in a pile of wood 100 ft. long, 8 feet high, and 4 feet wide.

100×4×8 = 3200 solid feet,
and 3200÷128 = 25 cords. Answer.

2. I demand the number of cords in a pile of wood 60 feet long, 6 feet high and 4 feet wide. Ans. $11\frac{1}{4}$ cords.

3. In a stack of bark measuring 24 feet 6 inches long, 19 feet 6 inches wide, and 12 feet high, how many cords?

Ans. 44 cords, 101 feet.

4. Required the solid content of a bale measuring 6 feet 6 inches long, 5 feet 6 inches wide, and 4 feet deep.

$6.5 \times 5.5 \times 4 = 143$ feet,

and $143 \div 40 = 3$ tons, 13 feet. Ans.

5. I demand the solid content of a load of bark measuring 13 feet 6 inches long, 3 feet 4 inches wide, and 2 feet $10\frac{1}{2}$ inches deep. Ans. 1 cord, 1.475 feet.

OF A CYLINDER.

A cylinder is a round solid, having its base circular, equal and parallel, in form of a roller used for rolling land.

To find the solidity.

RULE.

Multiply the area of the base by the length, and the product is the solid content.

Examples.

1. If a piece of timber be 6 feet in circumference, and 25 feet long, how many feet of timber are contained in it, supposing it to be perfectly cylindrical?

$6 \times 6 \times .07958 = 2.86488$,

and $2.86488 \times 25 = 71.622$ feet. Answer.

2. I have a rolling stone, 14 inches in diameter, and 6 feet long, required the solidity. Ans. 6.4141 feet.

OF A CONE.

A cone is a solid, having a circular base, and growing smaller and smaller, till it ends in a point, and may be nearly represented by a sugar loaf.

To find the solidity.

RULE.

Multiply the area of the base by a third part of the perpendicular height, and the product will be the solid content.

Note.—To find the perpendicular height, add the square of the slant height to the square of half the diameter of the base, the square root of this sum is the perpendicular height.

Examples.

1. What is the solidity of a cone, whose slant height is 10 feet, and diameter 16?

$10\times10 = 100$ square of the slant height.
$8\times 8 = 64$ square of half the diameter.

36 square of the perpendicular height.
and $\sqrt{36} = 6$ perpendicular height.
$16\times16\times.7854 = 201.0624$ area of the base.
$2 = \frac{1}{3}$ the perpendicular height.

402.1248 Answer.

2. A heap of grain on a barn floor, (in a conical form,) measures 10 feet in diameter, and the perpendicular height is 3 feet—I wish to know how many bushels it contains.

Ans. 63 bu. 3 qts.+

3. How many bushels of oats in a heap that measures 20 feet in diameter, and the perpendicular height 6 feet?

Ans. 504 bu. 3 pecks, 4 qts.+

OF A GLOBE OR SPHERE.

A globe or sphere is a round, solid body, having every part of its surface equidistant from a certain point within it, called its centre.

To find the solidity.

RULE.

Multiply the cube of the diameter by .5236, and the product will be the solidity required.

Examples.

1. The diameter of the earth is about 7964 miles, required its solidity in cubic miles.

$7964\times7964\times7964 = 505119057344$
and $505119057344\times.5236 = 264480338425.3184$ Ans.

2. The circumference of a globe is 31.416—What is the solidity? Ans. 523.6.

Ship's tonnage by carpenters' measure.

RULE.

Multiply the length, breadth at the main beam, and depth of the hold together, and divide the product by 95, the quotient will be the required tonnage for a single decked vessel: for double decked vessels, take half the breadth of the main beam for the depth of the hold, and work as for a single decked vessel.

Examples.

1. Required the tonnage of a single decked vessel, measuring as follows, viz. length 72 feet, bréadth 24 feet, and depth of the hold 10 feet.

$72 \times 24 \times 10 = 17280.$

and $17280 \div 95 = 181.85$ tons. Answer.

2. I demand the tonnage of a double decked vessel, whose length is 100 feet and breadth 32 feet.

Ans. 539 tons, nearly.

By government measure.

RULE.

Multiply the length, less three-fifths of the breadth, by the breadth, and this product again by the depth of the hold; divide by 95, and the quotient will be the tonnage required. If the vessel be double decked, take half the breadth for the depth of the hold, and work as for a single decked vessel.

Examples.

1. Required the government tonnage of a single decked vessel, whose length is 80 feet, breadth 25 feet, and depth 10 feet.

$\frac{3}{5}$ of 25 feet $= 15$ feet, and $80 - 15 = 65$ feet.

Then $65 \times 25 \times 10 = 16250$,

and $16250 \div 95 = 171$ tons. Answer.

2. I demand the government tonnage of a double decked vessel, whose length is 90 feet, and breadth 30 feet.

Ans. 341 tons.

Note 1.—For ships of war, divide the continual product of the length, breadth and depth in feet by 100, and the quotient will be the tonnage required.

Example.

Required the tonnage of a ship of war, length 100 feet, breadth 32 feet, and depth 16 feet. Ans. 512 tons.

Note 2.—To find the length of the mast of a ship, add the breadth of the beam to two-thirds the length of the keel, and the sum will be the length of the main mast.

Example.

1. What is the length of the main mast for a ship of 105 feet keel, and the breadth of the beam 38 feet? Ans. 108 ft.

STONE MEASURE.

Stone and stone work, or mason's work, is measured by the standard perch of 24.75 cubical or solid feet, which is $16\frac{1}{2}$ feet long, $1\frac{1}{2}$ feet wide, and 1 foot high.

RULE.

1. Divide the continued product of the length, width and height in feet by 24.75, and the quotient will be the number of perches.

Or, divide the continued product of the length and height, in feet, and width in inches, by 297, and the quotient will be the number of perches required.

If the wall be no more than the standard thickness, multiply only the length and height together, and divide the product by 16.5.

2. Place the length and height of the wall in feet, and the width in inches, for dividends, and the numbers 3, 9 and 11, for divisors; divide each of the dividends by one of the divisors, and the continued product of the quotients will be the number of perches required. It makes no difference in the result which divisor and dividend be used together; the work will, however, be abridged, by using such together as will leave no remainder, (if there be any such.)

Examples.

1. Required the number of perches in a pile of stone 27 ft. long, 9 feet high, and 55 inches wide.

3	27	9
9	9	1
11	55	5

} quotients.

$9 \times 1 \times 5 = 45$ perches. Ans.

2. Required the number of perches in a wall 94.5 ft. long, 22 feet high and 21 inches wide.

3	94.5	10.5= 94.5÷ 9
9	22	2 =22 ÷11
11	21	7 =21 ÷ 3

$10.5 \times 2 \times 7 = 147$ perches. Answer.

3. What quantity of stone is there in a wall 64 feet long, 24 feet high and 20 inches wide?

3	64	7.11 =64÷ 9
9	24	8 =24÷ 8
11	20	1.818=20÷11

$7.11 \times 8 \times 1.818 = 103.4$ perches. Answer.

Note 1.—In mason's work, the dimensions of a building are taken from corner to corner, that is, the girth of a building is reckoned the length of the wall. The dimensions of chimnies are taken separately, the girth and half girth of which is reckoned the length of the wall.

Note 2.—When the wall is less than $1\frac{1}{2}$ feet in width, no deduction is to be made, but reckoned at the standard thickness; nor is any deduction to be made for doors, windows and corners, except in reckoning the quantity of stone actually made use of, when all doors, windows, &c. are deducted.

4. A certain building measures as follows, viz: side walls each 90 feet 6 inches, ends each 74 feet 3 inches; thickness of each 20 inches; a partition wall 70 feet 11 inches, and 1 foot thick, and all 18 ft. 9 in. high; in the outside walls are four doors, 7 ft. 3 in. by 3 ft. 3 in. each, and twelve windows 5 ft. 4 in. by 3 ft. each, and in the partition wall are 2 doors, 6 feet 6 in. by 3 feet 2 in. each—Required the number of perches of mason's work, also the number of perches of stone.

Answer. { Mason's work, 496.622 perches.
Stone, 439.242 do.

To measure stone in a well.

Add the thickness of the wall to what it measures in the clear; then say, As 7 is to this sum, so is 22 to the circumference or length of the wall.

Examples.

1. Required the number of perches of stone in a well whose diameter in the clear is 3 feet 6 inches, thickness of the wall 18 inches, and depth 44 feet 11 inches.

Ans. $42\frac{7}{9}$ perches.

2. A certain well measures 4 feet 9 inches in the clear, the wall is 15 inches thick and 48 feet deep—Required the number of perches of stone. Ans. 45.7 perches +

3. Required the number of perches of stone in a well 30 feet deep, diameter in the clear 2 feet 4 inches, and thickness of the wall 1 foot 2 inches. Ans. 15.555 perches +

PAVING AND PLASTERING.

Paving and plastering are measured by the square yard.

RULE.

Reduce the area of the pavement to square inches, and divide this by the product of the length and breadth of the brick or stone.

Or, divide by the length of the brick, and that quotient by the breadth, for the number of bricks.

Or, multiply the length of the pavement by the breadth, and divide by 9, for the area in square yards.

Examples.

1. A certain yard $16\frac{1}{2}$ feet square, is to be paved with brick 9 inches long and $4\frac{1}{2}$ broad; required the number of bricks, the number of square yards, and price of paving at 8 cents a square yard.

$16\frac{1}{2} \times 16\frac{1}{2} = 272\frac{1}{4}$, and $272\frac{1}{4} \div 9 = 30\frac{1}{4}$ sq. yards.

$30\frac{1}{4}$ square yards = 39204 square inches.

$9 \times 4\frac{1}{2} = 40\frac{1}{2}$ square inches = area of a brick.

$39204 \div 40\frac{1}{2} = 968$ = number of brick.

$30\frac{1}{4} \times .08 = \$2.42$ = price of paving.

2. What will the plastering of a room come to at 9 cents a square yard, and measuring as follows, viz. two sides 13.25 feet by 8.75 feet each, and two ends 10.5 by 8.75 feet each, with a deduction for a door that is 6 feet long by 3.25 feet wide, and 3 windows 3.25 by 4 feet each. Ans. $\$3.57\frac{1}{2}$.

3. Suppose a certain pavement contains 3240 stones, 10 inches long and 8 inches wide, I require the number of square yards. Ans. 200 sq. yards.

SHINGLE OR ROOF MEASURE.

To compute the number of shingles for a Roof.

RULE.

1. Divide the breadth of the space to be roofed, in inches, by the average width of the shingles, and the quotient will be the number of shingles in a course.

2. Divide the length of the space to be roofed, in inches, by the number of inches the shingles are to be laid to the weather; this quotient will be the number of courses.

3. Multiply the number of shingles in a course by the number of courses, and the product will be the number of shingles required.

Examples.

1. How many shingles will be required for a roof 25 feet square, the courses to be laid $7\frac{1}{2}$ inches to the weather, and the shingles to average 6 inches in width?

25 feet = 300 inches.

$300 \div 6 = 50$ = number of shingles in a course.

$300 \div 7\frac{1}{2} = 40$ = number of courses;

and $50 \times 40 = 2000$ Answer.

2. Required the number of shingles it will take to make a roof 24 feet long and 20 feet broad, the shingles to be laid 8 inches to the weather, and to average $7\frac{1}{2}$ inches in width. Ans. 1152.

3. How many shingles will be required to roof a house 40 feet in length and 36 in breadth, the average width of the shingles $4\frac{1}{2}$ inches, and to be laid 10 inches to the weather? Ans. 4608.

To find the side of a square piece of timber, that may be hewn or sawed from a round piece.

RULE.

Extract the square root of half the square of the diameter. Or, multiply the girth by 9 and divide by 40, for the side of the square. Or, multiply the girth by 2 and divide by 9, the quotient will be the side of the square, near enough for common purposes.

Examples.

1. The girth of a tree is 8 feet 9 inches—I wish to know the side of a square piece of timber that may be hewn from it.

8 ft. 9 in. $\times 9 = 78$ ft. 9 in.
and 78 ft. 9 in. $\div 40 = 1$ ft. $11\frac{5}{8}$ in. Answer.
Or, 8 ft. 9 in. $\times 2 = 17$ ft. 6 in.
and 17 ft. 6 in. $\div 9 = 1$ ft. $11\frac{1}{3}$ in. Answer, nearly.

2. I wish to procure a piece of timber that will square 20 inches—What girth will be required?

20 in. $\times 9 = 180$;
and $180 \div 2 = 90$ in. $= 7$ ft. 6 in. Answer, nearly.

3. The diameter of a tree is 30 inches—How much will it square?

$30 \times 30 = 900$;
and $900 \div 2 = 450$, $\sqrt{450} = 21.2$ in. Answer.

MECHANICS.

OF THE LEVER.

There are three varieties of the lever, whereby the prop, moving power or weight may be applied differently to the inflexible bar or vectis, so as to effect mechanical operations in a convenient manner.

Of the Lever of the first order.

A lever of the first order has the power applied at one end, the weight to be raised at the other, and the prop or fulcrum at some point between them, as the common handspike or steelyards; therefore, the power applied at one end of this order of levers will be reciprocally proportional to the distance of the fulcrum or prop from those ends: Or, as the distance from the point of suspension is from the weight.

Examples.

1. What weight will a person be able to raise who presses with the force of 120 pounds on the end of an equipoised handspike 12 feet long, which is to meet with a convenient prop, just 9 inches above the end of the handspike?

12 feet = 144 inches, and 144—9 = 135.
in. in. lbs. lbs.
Then, As 9 : 135 :: 120 : 1800 Ans.

2. A gentleman, in giving directions for making a chaise, the length of the shafts between the axle-tree and back-band being settled at 8 feet, a dispute arose whereabout on the shafts the centre of the body should be fixed. The chaise-maker advised to place it 27 inches before the axle-tree; others supposing that 18 inches would be a sufficient incumbrance for the horse.—Now suppose two passengers to weigh 320 pounds, and the body of the chaise 80 pounds more, what will the beast in both these cases bear more than his harness?

Ans. { 112½ lbs. at 27 inches.
{ 75 lbs. at 18 inches.

3. What weight can I raise by pressing with a force of 100 pounds on the end of a handspike, 24 feet long, which has a prop exactly one foot above the end of the handspike?

Ans. 2300 pounds.

—

Of the Lever of the second order.

A lever of the second order is where the prop is fixed at one end, the power being applied to the other, and the weight somewhere between them. The force of this order of levers is in contra proportion to their length.

Examples.

1. A handspike 6 feet long being so placed that one end rests on a pavement 9 inches from a weight of 700 pounds, what weight applied to the other end will be sufficient to raise this weight?

6 ft.—9 in. = 5 ft. 3 in.
Then, As 5 ft. 3 in. : 9 in. :: 700 lbs. : 100 lbs. Ans.

2. If a handspike 11 feet long, be so placed as to rest on a prop at one end, the weight to be raised 16½ inches from the prop, and moved with a force of 200 pounds, I demand the weight it will raise. Ans. 1400 lbs.

—

Of the Lever of the third order.

A lever of the third order is where the prop is at one end, the weight at the other, and the moving power or force somewhere between them.

Example.

A certain water wheel turns a crank which works three pump rods, fixed exactly 5 feet from the joint or pin by which their several levers, each 8 feet in length, are fastened for the sake of the intended motion at one end, the suckers of the pump being worked by the other, shews them to be levers of the third order.—Now I wish to know what the length of the stroke of each of the barrels will be, admitting the crank to play just 8 inches round the centre.

$8 \times 2 = 16$ diameter of the crank.

Then, As 5 ft. : 8 ft. :: 16 in. : 25.6 in. Ans.

OF THE WHEEL AND AXLE.

When the weight is to be raised by a rope, which coils about the axle as the wheel turns around, and the power applied to the circumference of the wheel—say, As the diameter of the axle, is to the diameter of the wheel, so is the power applied to the wheel, to the weight to be raised.

Examples.

1. Suppose the axle of a windlass be $4\frac{1}{2}$ inches in diameter, the diameter of the wheel 3 feet, and 2 pounds applied to the wheel—I wish to know how many pounds may be raised.

As $4\frac{1}{2}$ in. : 3 ft. :: 2 lbs. : 16 lbs. Ans.

2. I wish to make a windlass, in such a manner that $1\frac{1}{2}$ pounds applied to the wheel shall equal $16\frac{1}{2}$ pounds suspended from the axle—Now supposing the diameter of the wheel to be 2 ft. 9 in., required the diameter of the axle.

Ans. 3 inches.

3. The diameter of the axle is $7\frac{1}{2}$ inches, the weight applied 40 lbs. and the weight to be raised 320 lbs.—Required the diameter of the wheel. Ans. 5 feet.

4. The diameter of the axle is 5 inches, the diameter of the wheel 5 feet, and the weight to be raised 240 lbs.—What weight is sufficient? Ans. 20 lbs.

OF THE SCREW.

The power of the screw is to the distance between the threads, as the weight which is to be raised is to the circumference of a circle applied at the end of the lever or handspike, by which the screw is turned.

Examples.

1. What weight will a screw of a half inch thread raise, the lever being 40 inches, and the pressing power or force to be 50 pounds?

$40 \times 2 = 80$ inches = diameter.
$3.1416 \times 80 = 251.328$ = circumference.
As $\frac{1}{2}$ in. : 251.328 :: 50 lbs. : 25132.8 lbs. Ans.

2. There is a screw whose threads are one inch asunder; the lever or handspike by which it is turned is 25 inches long, and the weight to be raised 2000 pounds—What power or force must be applied to the end of the lever or handspike, sufficient to turn the screw by which the weight is to be raised?

$25 \times 2 = 50$ = diameter.
and $50 \times 3.1416 = 157.08$ circumference.
in. in. lbs. lbs.
Then, As 157.08 : 1 :: 2000 : 12.732+ Ans.

OF THE SPECIFIC GRAVITIES OF BODIES.

The specific gravities of bodies are as their weights or densities, bulk for bulk; thus we say a body has twice as much matter when it contains twice as much matter in the same space.

If a body be immersed in any fluid, it will sink if it be heavier than its bulk of that fluid; but if it be lighter it will swim. Rain water is taken as the standard for immersing bodies in, in order to determine their specific gravity, one cubic or solid foot of which weighs about $62\frac{1}{2}$ pounds or 1000 ounces avoirdupois. Now, if any body heavier than water be suspended therein, it will lose so much of what it weighed in air, as the bulk of the water it displaces would weigh; all bodies, therefore, that will sink in water, if of equal bulks, lose equal weights when suspended therein, and unequal bodies lose in proportion to their bulks.

Specific gravities are found by hydrostatic scales, which may be constructed in the form of a common balance, except that a hook should be fixed at the bottom of each scale, from which a body may be suspended, and immersed in the water, without wetting the scale.

TABLE OF SPECIFIC GRAVITIES.

A cubic foot of	ounces.	*A cubic foot of*	ounces.
Platina, rendered malleable and hammered,	20170	Nitre,	1900
Gold, pure,	19637	Ivory or horn,	1832
old standard, 22 carats fine,	18888	Brimstone,	1800
new do. $21\frac{2}{43}$,	18739	Alum,	1714
Quicksilver,	13600	Clay,	1712
Alloy, such as used with pure gold,	13306	Brick,	1517
Lead,	11325	Pitch,	1150
Silver, pure	11087	Ebony,	1117
standard	10535	Mahogany,	1063
Copper,	8843	Human blood,	1054
Plate brass,	8000	Sea water,	1030
Steel,	7852	Cow's milk,	1030
Cast brass,	7850	Box wood,	1030
Bar iron,	7645	Rain water,	1000
Block tin,	7321	Bee's wax,	996
Cast iron,	7135	Red wine,	993
Load stone,	5106	Linseed oil,	935
Slate,	3500	Dry oak,	925
Diamond,	3400	Proof spirits or brandy,	925
Chrystal glass,	3150	Olive oil,	913
White marble,	2707	Spirits of turpentine,	864
Black do.	2704	Beech wood,	854
Rock chrystal,	2656	Gun powder,	852
Green glass,	2624	Alcohol or pure spirits,	850
Clear do.	2600	Elm and ash,	800
Flint stone,	2582	Wheat,	771
Paving do.	2570	Rye and Indian corn,	746
Cornelian do.	2568	White pine,	569
Common do.	2520	Cedar,	513
Free do.	2352	Sassafras,	482
		Cork,	242
		Common air,	$1\frac{1}{4}$
		Inflammable air,	$\frac{3}{25}$

The specific gravities of several solid and fluid bodies are shown in the preceding table, from whence the magnitude of any given body may be found by its weight, or the weight may be found by its magnitude.

RULE.

1. Divide the weight in ounces by the specific gravity, and the quotient will be the magnitude in cubical feet.

2. Multiply the specific gravity by the magnitude in cubical feet, and the product will be the weight in ounces.

Examples.

1. What is the weight of eight cubical feet of gunpowder?
852×8=6816 ounces=426 pounds. Ans.

2. What is the weight of a brick 9 inches long, 4½ broad, and 2½ thick? Ans. 5 pounds.

3. How many bushels of wheat in a granary containing 49 cubical feet, each bushel weighing 60 pounds?
Ans. 39 bu. 1 peck, 3.3 qts.

4. Required the content of a load of white pine boards whose weight is 3414 pounds.
Ans. 96 cubical feet,=1152 ft. board measure.

To find the specific gravity of a body having its weight given.

RULE.

If the body be heavier than water, weigh it both out of the water and in the water, and the difference of these weights will be the weight lost in water: then say—

As the weight lost in water,
Is to the whole weight of the body,
So is the specific gravity of water, or 1000,
To the specific gravity of the body.

Examples.

1. A piece of plate brass weighs 8 pounds in air and 7 pounds in water—Required its specific gravity.
8—7=1=weight lost in water.
Then, As 1 lb. : 8 lbs. :: 1000 oz. : 8000 oz. Answer.

2. A piece of diamond weighs 17 grains in air, and 12 in water—What is its specific gravity? Ans. 3400.

Note.—If the body be lighter than water, and will not sink, affix a piece of another body, heavier than water, to it, so that both may sink; then weigh the heavier and the compound mass separately, both in the air and in the water, subtract their weight in water from their weight in air, and again take the difference of these remainders. Then say—

As this last remainder,
Is to the weight of the lighter body in air,
So is the specific gravity of water, or 1000,
To the specific gravity of the body.

Examples.

3. A piece of cork weighs two pounds in air, and a piece of glass that weighs 13 pounds in air and 8 pounds in water, is affixed to it, and the compound weighs $1\frac{2}{3}$ pounds in water: I wish to know the specific gravity of the cork.

Glass { 13 in air, / 8 in water. } Compound { 13+2=15 in air / $1\frac{2}{3}$ in water

$13\frac{1}{3}$ loss
5

$8\frac{1}{3}$ remainder.

As $8\frac{1}{3}$: 2 :: 1000 : 240 Answer.

To find the quantity of two ingredients in a given compound.

RULE.

Find the difference of each pair of specific gravities, viz. the specific gravity of the compound and each ingredient; multiply the difference of every two specific gravities by the third: then say—

As the sum of the products,
Is to each of the other products respectively,
So is the weight of the compound,
To the two weights of the ingredients.

Examples.

1. The weight of the American Eagle, coined prior to July 31, 1834, is 270 grains, and its specific gravity 18888; it is composed of pure gold and alloy—I wish to know what weight of each metal it contains, the specific gravity of pure gold being 19637, and that of the alloy 13306.

19637—18888= 749, and 749×13306 = 9966194
18888—13306=5582, and 5582×19637=109613734

119579928

As 119579928 : 9966194 :: 270 : $22\frac{1}{2}$ grains of alloy
119579928 : 109613734 :: 270 : $247\frac{1}{2}$ pure gold } Ans.

2. The weight of the American Eagle, coined after July 31, 1834, is 258 grains, and its specific gravity 18739—I wish to know how much pure gold, also how much alloy it contains.

19637—18739= 898, and 898 × 13306= 11948788
18739—13306=5433, and 543 × 19637 =106687821

118636609

As 118636609 : 11948788 :: 258 : 26 grains of alloy } Ans.
118579928 : 106687821 :: 258 : 232 pure gold }

To ascertain whether spirituous liquors be above or below proof.

RULE.

As 1728 inches, or one cubic foot,
Is to 231, the cubic inches in a gallon,
So is the specific gravity of proof spirits,
To the weight of one gallon of proof spirits.

Note.—The better spirits are, the lighter they are; and the worse, the heavier.

Examples.

1. How much ought a gallon of proof spirits to weigh?

As 1728 : 231 :: 925 oz. : 123.6545 oz. Ans.

2. I demand the weight of a gallon of alcohol or pure spirits.

As 1728 : 231 :: 850 oz. : 113.6284 oz. Ans.

To find the pressure of water against a sluice or bank.

RULE.

Multiply the depth of the centre of gravity (which is always equal to half the depth of the water,) in feet, by the area of the sluice under water: multiply that product again by 62½ pounds avoirdupois, for the pressure required.

Examples.

1. Required the pressure of water against a sluice or bulk head, 40 feet long, depth of water 6 feet.

40×6=240, area of the side, and 3×240=720 cubic ft.
Then, 720 × 62½ =45000 pounds. Answer.

2. What is the pressure on the bottom of a vessel 3 feet wide, 4 feet long and 5 feet deep? Ans. 3750 pounds.

3. The pressure of atmospheric air on a cubic foot is found to be 2125 pounds, I wish to know what height of water this is equal to. Ans. 34 feet.

4. I demand the pressure of atmospheric air on an ordinary sized chaise body, whose surface is estimated at 14 square feet. Ans. 29750 pounds.

GUAGING.

GUAGING is the art of measuring and computing the capacity or content, in gallons or bushels, of any vessel, granary, box, &c.

The dimensions are commonly taken in inches and tenths of an inch, and the capacity or content computed in bushels or gallons.

The standard bushel for the measurement of grain, &c. contains 2150.42 cubic inches, and a gallon for the measurement of liquids contains 231 cubic inches. [See section 2 of the acts of Assembly, at page 33.] These are divisors for square or oblong vessels.

Multipliers and divisors for circular vessels are thus found: If the diameter of a circle be 1, the area is .7854; this being divided by 2150.42, gives .000365, and divided by 231, gives .0034 nearly; these are therefore multipliers for circular vessels, the former for bushels and the latter for gallons. Or, if 2150.42 be divided by .7854, the quotient will be 2738, and 231 divided by the same number, quotes 294.12; these quotients are divisors for like vessels for bushels and gallons.

CASE I.

To find the capacity of an oblong or square box, granary, or cistern, having the length, width and depth given.

RULE.

Multiply the length, width and depth together, and divide the product by the cubic inches in a bushel or gallon.

Examples.

1. I demand the number of bushels a granary will hold 96 inches long, 60 inches wide, and 50 inches deep.

$96\times60\times50=288000;$

and $288000\div2150.42=133.927$ bushels. Ans.

2. Required the number of gallons a cistern will hold, that is 100 inches long, 75 wide, and 60 inches deep.

Ans. 1948+

3. Required the number of gallons in one cubical foot.

Ans. 7,48+

4. Required the quantity of wheat contained in a cubical foot. Ans. 3 pecks, 1.714 qts.

Note.—Heaped measure is about three-sixteenths more than level measure, the bushel of which is 2553.62 cubical inches. [See page 41.]

5. How many bushels of charcoal will a box hold that is 150 inches long, 50 inches wide and 48 inches deep?

Ans. 141 bushels, nearly.

6. How many bushels of lime are contained in a wagon 110 inches long, 42 inches wide and 18 inches deep?

Ans. $32\frac{1}{2}$ bushels+

CASE II.

To find the capacity of a cylindrical or circular vessel, having the same diameter throughout.

RULE.

Multiply the square of the diameter by .000365 for bushels struck measure; by .0003076 for heaped measure, and by .0034 for gallons, which being multiplied by the length or depth of the vessel, will give the capacity required.

Examples.

1. Required the capacity, in bushels, level measure, of a vessel in form of a cylinder, the length or depth 60 inches, and diameter 67.5 inches.

$67.5\times67.5\times.000365\times60=99.781875,$

or 100 bushels, nearly. Answer.

2. A bag of potatoes is 40 inches long and 20 inches in diameter—How many bushels does it contain?

Ans. 4.9216 bu.

3. Required the capacity in gallons of a circular cistern, 90 inches in diameter and 120 inches deep?

Ans. 3304.8 gallons.

4. I demand the capacity in gallons of a vessel in form of a cylinder, diameter 10 inches, and the length or depth 20 inches. Ans. 6.8 gallons.

Case III.

To find the capacity of a circular vessel, wider at one end than at the other.

Rule.

1. Add $\frac{1}{3}$ of the square of the difference of the diameters to the product of the diameters, this sum will be the square of the mean diameter; then proceed as in case 2, for the capacity required.

2. To the product of the diameters add the sum of their squares; multiply this sum by one-third the height, and that product, multiplied by .0034, will give the capacity in gallons, and by .000365, the capacity in bushels.

Examples.

1. Required the capacity in gallons of a vessel, the greater diameter being 30 inches, that of the lesser 24 inches, and the length 50 inches.

$30 \times 24 = 720$
$30 - 24 = 6$, and $6^2 \div 3 \quad 12$ } 732

Then, $732 \times .0034 \times 50 = 124.44$ gallons. Answer.

2. What is the content in gallons of a tub, the diameters being 45 and 36 inches, and depth 54 inches; also how many bushels will it hold?

Ans. { 302.3892 gallons.
{ 32.46237 bushels.

3. What is the content in gallons of a tub whose diameters are 22 and 18 inches, and depth 12 inches? Ans. 16.3744.

Note.—To find the capacity of a vessel whose bottom is hollowing or uneven.

Rule.

Take the depth in several places; add the several depths together, and divide the sum by the number of depths taken,

for a mean depth. The capacity may then be found either by Case 2 or 3, as it is a straight or tapering vessel.

Examples.

1. The diameter of a kettle is 48 inches, the depth in the middle 26 inches, at the edge 22, and half way between the middle and edge 24 in.—How many gallons does it contain?

$26+22+24=72$, and $72\div3=24$ mean depth.
Then $48\times48\times.0034\times24=188.0064$ gallons. Ans.

2. The diameter of a copper kettle is 40 inches, and the several depths 12, 13, 15 and 16 inches—Required the content in gallons. Ans. 76.16 gallons.

CASE IV.

To find the content of a still or boiler.

RULE.

Add together the square of the greater end, the square of the less, and four times the square of the section parallel to and equidistant from the two ends; this sum being multiplied by one-sixth of the depth in inches, and again by the proper multiplier, will give the capacity in gallons or bushels, as required.

Examples.

1. I wish to know the capacity in gallons of a spherical boiler, the diameter of the mouth (inside) being 90 inches, that of the bottom 50 inches, that of the middle section (equi-distant from the mouth and bottom) 75 inches, and the depth 36 inches.

$$\left.\begin{array}{r} 90\times90=\ 8100 \\ 50\times50=\ 2500 \\ 75\times75\times\ 4=22500 \end{array}\right\} \quad 36\div6=6 \text{ one-sixth the depth.}$$

33100 and $33100\times6\times.0034=675.24$ galls.
Answer.

2. The body of a still measures as follows, viz: the diameter of the greatest section (inside) 40 inches, mouth 8 inches, bottom 27 inches, middle section between greatest section and

mouth 33 inches, middle section between greatest and bottom 37 inches, depth from the mouth to the greatest section 12 inches, and from that to the bottom 28 inches—I wish to know the capacity in gallons.

$40\times40=1600$
$8\times\ 8=\ \ 64$
$33\times33\times\ 4=4356$

$6020\times\overline{12\div6}=12040$

$40\times40=1600$
$27\times27=\ 729$
$37\times37\times\ 4=5476$

$7805\times\overline{28\div6}=13090$

} 25130 sum.

and $25130\times.0034=85.442$ gallons. Answer.

Note.—The content of a corn crib, cistern, &c. whose sides or bases are parallel, but unequal, may be found by the following

RULE.

Find the area of each side or base separately; add the square root of the product of these areas to their sum; multiply this last sum by one third of the depth or height, and divide by the number of cubical inches in a bushel or gallon, for the content required.

Examples.

1. Required the number of bushels (heaped measure) in a corn crib 20 feet in length at the bottom, and 4 feet wide, 24 feet at the top, and 4 ft. 6 in. wide, the height being 7 feet.

$240\times48=11520$ } Sum, pounds.
$288\times54=15552$ } 27072 and $11520\times15552=179159040$
$\surd179159040=13385$

Last sum $=40457\times\overline{84\div3}=1132796$
and $1132796\div2553.62=443.6$ bu. nearly. Answer.

2. I wish to know the capacity of a cistern of the following dimensions, viz: the length of the greater side 80 inches, and that of the less side 64 inches; the breadth at the top 56

inches, and that at the bottom 45 inches, the height or depth being 50 inches. Ans. 810.4 gallons.

CASK GUAGING.

In order to perform this part of guaging, the three following dimensions of the cask must be accurately taken, viz. the bung diameter, the head diameter, and the length of the cask, all taken inside of the cask, or by proper allowance reduced to inside measure.

Rule.

Multiply the difference between the bung and head diameter, in inches, by .67, by .64 or by .6, according as the cask is more or less arching; add the head diameter to this product, the sum will be the mean diameter, or that of a cylinder; the continued product of this mean diameter, the length of the cask in inches, and .0034, will give the capacity in gallons.

Note.—The multiplier .67, is used for casks of the greatest curvature, .64 for those of a moderate curvature, and .6 when of the least curvature, or when the staves are nearly straight.

Examples.

1. I wish to know the capacity in gallons of a cask whose bung diameter is 40 inches, head diameter 28 inches, and length 36 inches.

40—28=12, and 12×.67=8.04

To which add 28.00 head diameter.

36.04 mean diameter.

36.04 ⋈ 36.04 ⋈ 36 ⋈ .0034=159 gallons, nearly. Ans.

2. Required the capacity in gallons of a cask whose bung diameter is 32 inches, head diameter 25 inches, and length 41 inches, (second form.)

32—25=7, and 7 ⋈ .64= 4.48

add 25 head diameter.

29.48 mean diameter.

29.48 ⋈ 29.48 ⋈41 ⋈.0034=121 galls.+ Ans.

3. I demand the capacity in gallons of a cask whose bung diameter is 22 inches, head diameter 18 inches, and the length 25 inches, (third form.)

22—18=4, and 4×.6 = 2.4
add 18

20.4 mean diameter.

20.4 ⋈ 20.4 ⋈ 25 ⋈ .0034=35.3736 gallons. Ans.

Note.—Some guage by what is called "Ivin's rule," viz: take the diagonal of the cask, from the middle of the bung hole to the end of the opposite stave; cube the said diagonal, and divide the cube by 370, the quotient will be the capacity required. If the bung hole be not exactly in the middle of the cask, measure the diagonal each way, add the diagonals together, and take half their sum for a mean diagonal.

Examples.

1. Required the capacity in gallons of a cask whose diagonal is 24 inches.

24 ⋈ 24 ⋈ 24=13824, and 13824÷370=37.36 galls. Ans.

2. I demand the capacity in gallons of a cask whose diagonal is 33½ inches.

33.5 ⋈ 33.5 ⋈ 33.5=37595.375,
and 37595.375÷370=101.6 gallons. Answer.

3. I wish to know the capacity in gallons of a cask whose diagonal is 36 inches.

36 ⋈ 36 ⋈ 36=46656, and 46656÷370=126 galls.+ Ans.

4. Required the capacity of a cask whose diagonal is 29 inches.

29 ⋈ 29 ⋈ 29=24389, and 24389÷370=65.9 galls. Ans.

A TABLE

Shewing the capacity of any cask whose diagonal is given, computed to the nearest quart.

In.	gal. qt.	In.	gal. qt.	In.	gal. qt.	In.	gal. qt.
12	4 3	18¼	16 2	24½	40 0	30¾	79 0
12¼	5 0	18½	17 0	24¾	41 0	31	80 2
12½	5 1	18¾	17 3	25	42 1	31¼	82 2
12¾	5 2	19	18 2	25¼	43 2	31½	84 2
13	6 0	19¼	19 1	25½	44 3	31¾	86 2
13¼	6 1	19½	20 0	25¾	46 1	32	88 2
13½	6 2	19¾	20 3	26	47 2	32¼	90 3
13¾	7 0	20	21 2	26¼	49 0	32½	92 3
14	7 2	20¼	22 2	26½	50 1	32¾	95 0
14¼	7 3	20½	23 1	26¾	51 3	33	97 0
14½	8 1	20¾	24 1	27	53 1	33¼	99 2
14¾	8 3	21	25 0	27¼	54 3	33½	101 2
15	9 0	21¼	26 0	27½	56 1	33¾	103 3
15¼	9 2	21½	26 3	27¾	57 3	34	106 1
15½	10 0	21¾	27 3	28	59 1	34¼	108 3
15¾	10 5	22	28 3	28¼	61 0	34½	111 0
16	11 0	22¼	29 3	28½	62 2	34¾	113 2
16¼	11 2	22½	30 3	28¾	64 1	35	115 3
16½	12 0	22¾	31 3	29	66 0	35¼	118 1
16¾	12 3	23	33 0	29¼	67 3	35½	121 0
17	13 1	23¼	34 0	29½	69 2	35¾	123 2
17¼	13 3	33½	35 0	29¾	71 1	36	126 0
17½	14 2	23¾	36 1	30	72 3	36¼	128 3
17¾	15 0	24	37 1	30¼	74 3	36½	131 2
18	15 3	24¼	38 2	30½	76 3	36¾	134 1

OF THE ULLAGE OF CASKS.

The ullage of a cask is what it wants of being full.

RULE.

Divide the dry inches of the bung diameter by the bung diameter; then multiply the corresponding multiplier in the following table, by the whole capacity, the product will be the ullage; deduct the ullage from the whole content, and the remainder will be the quantity left in the cask.

TABLE.

Quot.	Mult.	Quot.	Mult.	Quot.	Mult.	Quot.	Mult.	Quot.	Mult.
.01	.0017	.11	.0598	.21	.1527	.31	.2640	.41	.3860
.02	.0048	.12	.0680	.22	.1631	.32	.2759	.42	.3986
.03	.0087	.13	.0767	.23	.1738	.33	.2878	.43	.4110
.04	.0134	.14	.0851	.24	.1845	.34	.2998	.44	.4238
.05	.0187	.15	.0941	.25	.1955	.35	.3119	.45	.4364
.06	.0245	.16	.1033	.26	.2066	.36	.3241	.46	.4491
.07	.0308	.17	.1127	.27	.2178	.37	.3364	.47	.4618
.08	.0375	.18	.1224	.28	.2292	.38	.3487	.48	.4745
.09	.0446	.19	.1336	.29	.2407	.39	.3611	.49	.4873
.1	.0520	.2	.1454	.3	.2523	.4	.3735	.5	.5000

To find the multiplier for any quotient from this table.

RULE.

Take the multiplier answering to the two first quotient figures; take also the difference between this multiplier and the next greater, and multiply this difference by the given number, exclusive of the first two figures, crop off at the right hand of the product as many figures as you had figures of the given number, to multiply by, then add the remaining left hand figures of this product to the multiplier taken from the table.

Examples.

1. Required the multiplier answering to the quotient .176452.

.1224 next greater multiplier.
.1127 given multiplier.

97 difference.
×.6452 given number, exclusive of the first two figures.

625844 product.
and .1127+63=.1190 multiplier. Answer.

Here 63 is added because 625844 is nearer 630000 than 620000.

2. Required the multiplier answering to the quotient .3861. Ans. .3687.

3. Required the multiplier answering to the quotient .4875. Ans. .4841.

4. Required the multiplier answering to the quotient .2567. Ans. .2029.

5. Required the multiplier when the bung diameter is 30 inches, dry inches 10. Ans. .2918.

6. Suppose the bung diameter of a cask to be 31.4 inches, of which 7.8 inches were dry, whole capacity 122.4 gallons; required the ullage, and also the quantity of liquor in the cask.

7.8÷31.4=.2484 quot., and .1937=multiplier.

.2484×122.4=23.70888 ullage.

and 122.4—23.70838=98.68112 galls. of liquor. Ans.

7. The bung diameter of a cask is 32 inches, of which 12 inches are dry, whole capacity 100 gallons; I wish to know how many gallons are contained in the cask.

Ans. 65 galls. 3 qts.

8. The bung diameter of a cask is 21 inches, of which 7 inches are dry, whole capacity 32 gallons—I wish to know the quantity of liquor in the cask. Ans. 22.6624 galls.

Note.—If more than one half of the bung diameter be dry, use the wet inches the same as directed for the dry in the rule, and the result will be the quantity of liquor in the cask.

9. Suppose the bung diameter of a cask be 28 inches, of which $17\frac{1}{2}$ are dry, whole capacity 80 gallons—I wish to know the quantity of liquor in the cask. Ans. 27.4 galls.

To ullage a standing Cask.

RULE.

Multiply the square of the distance of the liquor's surface from the middle of the cask, by the difference between the squares of the bung and head diameters, and divide the product by the square of half the length of the cask; subtract one-third of the quotient from the square of the bung diameter, and multiply the remainder by the distance of the liquor's surface from the middle of the cask. The last product divided by 294.12, will give the quantity above or under half the content of the cask, according as the wet inches exceed or fall short of half the length of the cask.

Examples.

1. Suppose the length of a cask to be 40 inches, the bung diameter 32 inches, the head diameter 24 inches, the wet inches 26, and content 117 gallons; how many gallons are in the cask?

$32\times32=1024$ square of the bung diameter.
$24\times24=\ 576$ square of the head diameter.

448 difference of the squares of the diameters.

$40\div2=20$, and $26-20=6$ distance of the liquor's surface from the middle of the cask.

$6\times6=36$, and $36\times448=16128$.
$20\times20=400$, and $16128\div400=40.32$ quotient.
$40.32\div3=13.44=\frac{1}{3}$ of the quotient.
$1024-13.44=1010.56$, and $1010.56\times6=6063.36$
$6063.36\div294.12=20.615$ gallons above the half content.
$117\div2=59.5$, and $59.5+20.615=80.115$ Answer.

2. The bung diameter of a standing cask is 35 inches, head diameter 28.7, length 40, wet inches 10, content 148.5 gallons—required the content in the cask. Ans. 33.74 galls.

3. The length of a standing cask is 48 inches, the bung diameter 36 inches, the head diameter 33 inches, whole capacity 195.376 gallons, and 40 wet inches—I wish to know how many gallons are in the cask. Ans. 166.521 gallons.

TABLE

Showing the weight, contents in pure gold, old value, and new value of the principal gold coins throughout the world, as established by act of Congress of session 1833–'4.

Old standard, 22 carats—New standard, 21 carats $2\frac{14}{43}$ grs. by which the actual value of the Eagle coined prior to July 31st, 1834, is $10.668; that coined since, $10.

Note.—The tables at pages 54, 55 and 130 were prepared previous to the passage of this act, and were inadvertently put to press without the necessary alterations being made. The pupil is requested to compute the gold coins according to this table.

Names of Coins.	Weight.	Contents in pure gold.	Old value.	New value.
AUSTRIAN DOMINIONS.	grains	grains.	$	$
Souverain,	86	78.6	3.176	3.388
Double Ducat,	108	106.4	4.299	4.586
Hungarian do.	53¾	53.3	2.154	2.297
BAVARIA.				
Carolin,	149¼	115	4.646	4.956
Max d'or or Maximillian,	100	77	3.111	3.318
Ducat,	53¾	52.8	2.133	2.276
BERNE.				
Ducat—double in proportion,	47	45.9	1.854	1.977
Pistole,	117	105.5	4.262	4.546
BRAZIL.				
Johannes—½ in proportion,	432		16.	17.068
Dobraon,	822	759.	30,666	32.714
Moidore—½ in proportion,	166	152.2	6.149	6.500
Crusado,	16¼	14.8	.598	.637
BRUNSWICK.				
Pistole—double in proportion,	117¼	105.7	4.271	4.556
Ducat,	53¾	51.8	2.092	2.231
COLOGNE.				
Ducat,	53¾	52.6	2.125	2.267
COLOMBIA.				
Doubloon,	416½		14.56	15.532
DENMARK.				
Ducat, current,	48	42.2	1.705	1.818
Ducat, specie,	53¾	52.6	2.125	2.267
Christian d'or,	103	93.3	3.77	4.021
EAST INDIES.				
Rupee, Bombay, 1818,	179	164.7	6.654	7.096
Rupee of Madras, 1818,	180	165.	6.667	7.11
Pagoda, star,	52¾	41.8	1.689	1.801
ENGLAND.				
Guinea—½ in proportion,	129½	118.7	4.796	5.116
Sovereign, do	123¼	113.1	4.57	4.875
Seven shilling piece,	43	39.6	1.60	1.706
FRANCE.				
Double Louis, coined before 1786,	251	224.9	9.087	9.694

Names of Coins.	Weight.	Contents in pure gold.	Old value.	New value.
	grains.	grains.	$	$
Louis, coined before 1786.	125½	112.4	4.541	4.844
Double Louis, coined since 1786,	236	212.6	8.59	9.163
Louis, do. do.	118	106.3	4.293	4.581
Double Napoleon, 40 francs	199	179.	7.232	7.713
Napoleon, or 20 do.	99½	89.7	3.624	3.866
FRANKFORT ON THE MAINE.				
Ducat,	53¾	52.9	2.137	2.279
GENEVA.				
Pistole, old,	103¼	92.5	3.737	4.086
Pistole, new,	84¼	80.	3.232	3.448
HAMBURG.				
Ducat—double in proportion	53¾	52.9	2.137	2.279
GENOA.				
Sequin,	53¾	53.4	2.158	2.302
HANOVER.				
George d'or,	102½	92.6	3.741	3.989
Ducat,	53¾	53.3	2.154	2.297
Gold Florin—double in pro.	50	39.	1.576	1.687
HOLLAND.				
Double Ryder,	309	283.2	11.442	12.206
Ryder,	153	140.	5.655	6.043
Ducat,	53¾	52.8	2.133	2.276
Ten Guilder piece—5 do. in proportion,	104	93.2	3.766	4.017
MALTA.				
Double Louis,	256	215.3	8.699	9.276
Louis,	128	108.	4.364	4.655
Demi Louis,	64	54.5	2.202	2.349
MEXICO.				
Doubloons—shares in prop.	416½		14.56	15.532
MILAN.				
Sequin,	53¾	53.2	2.15	2.293
Doppia, or pistole,	97½	88.4	3.572	3.801
Forty Lire piece, 1808,	200	179.7	7.261	7.746
NAPLES.				
Six Ducat piece, 1783,	136	121.9	4.925	5.254
Two do. or Sequin, 1762,	44½	37.4	1.511	1.611
Three do. or Oncetta, 1818,	58½	58.1	2.347	2.502

Names of Coins.	Weight.	contents in pure gold.	Old value.	New value.
	grains.	grains.	$	$
NETHERLANDS.				
Gold Lion, or 14 florin piece	127¾	117.1	4.731	5.047
Ten florin piece, 1820,	103¾	93.2	3.766	4.017
PARMA.				
Quadruple Pistole—double in proportion,	441	386.	15.596	16.639
Pistole of Doppia, 1787,	110	97.4	3.935	4.198
do. do. 1796,	110	95.9	3.875	4.139
Maria Theresa, 1818,	99½	89.7	3.624	3.87
PIEDMONT.				
Pistole, coined since 1785—half in proportion,	145	125.6	5.075	5.414
Sequin—half in proportion,	53¾	52.9	2.127	2.279
Carlino, coined since 1785—half in proportion,	702	634.4	25.632	27.349
Piece of 20 Francs, called Marengo,	99¼	82.7	3.341	3.565
POLAND.				
Ducat,	53¾	52.9	2.137	2.279
PRUSSIA.				
Ducat, 1748,	53¾	52.9	2.137	2.279
do. 1787,	53¾	52.6	2.125	2.267
Frederick double, 1769,	206	185.	7.475	7.974
do. do. 1800,	206	184.5	7.454	7.952
do. do. 1778,	103	92.8	3.749	3.999
do. do. 1800,	103	92.2	3.725	3.973
PORTUGAL.				
Dobraon,	828	759.	30.666	32.714
Dobra,	438	401.5	16.222	17.305
Johannes,	432			17.068
Moidore—half in proportion,	166		16.	6.56
Piece of 16 Pestoons, or 1600 Reas,	54	152.2 49.3	6.149 1.992	2.125
Old Crusado of 400 Reas,	15	13.6	.549	.585
New do. of 480 Reas,	16¼	14.8	.598	.637
Millrea, coined in 1755,	19¾	18.1	.732	.789
ROME.				
Sequin, coined since 1760,	52½	25.2	2.109	2.258
Scudo of the republic,	408¼	367.	14.828	15.818

Names of Coins.	Weight.	Contents in pure gold.	Old value.	New value.
RUSSIA.	grains.	grains.	$	$
Ducat, 1796,	54	53.2	2.15	2.293
do. 1763,	53¾	52.6	2.125	2.267
Gold Ruble, 1756,	24½	22.5	.909	.969
do. 1799,	18¾	17.1	.691	.737
Gold Pollin, 1777,		8.2	.331	.353
Imperial, 1801,	195¼	181.9	7.349	7.84
Half do. 1801,	92½	90.9	3.673	3.924
do. do. 1818,	99½	91.3	3.689	3.935
SARDINIA.				
Carlino—half in proportion,	247½	219.8	8.881	9.474
SAXONY.				
Ducat, 1784,	53¾	52.6	2.125	2.267
do. 1797,	53¾	52.9	2.137	2.279
Augustus, 1754,	102½	91.2	3.685	3.921
do. 1784,	102½	92.2	3.725	3.974
SICILY.				
Ounce, 1751	68⅓	58.2	2.351	2.508
Double Ounce, 1758	137	117.	4.727	5.042
SPAIN.				
Quadruple Pistole or Doubloon, 1772, double and single, and shares in proportion,	416⅔	377.2	15.03	16.034
Doubloon, 1801,	417	360.5	14.56	15.532
Pistole, 1801,	104¼	90.1	3.64	3.882
Coronilla gold dollar or vinteur, 1801,	27	22.8	.921	.982
SWEDEN.				
Ducat,	53	51.9	2.097	2.237
SWITZERLAND.				
Pistole of Helvetic republic,	117½	105.9	4.279	4.504
TREVER.				
Ducat,	53⅜	52.6	2.125	2.267
TUSCANY.				
Zechino or Sequin,	53¾	53.6	2.166	2.31
Ruspone of the kingdom of Etruria,	161¼	161.	6.503	6.939

Names of Coins.	weight.	contents in pure gold.	Old value.	New value.
TURKEY.	grains.	grains.	$	$
Sequin Fonducli of Constantinople, 1773,	53¾	43.3	1.749	1.865
do. do. 1789,	53¾	42.9	1.733	1.848
Half Misseir, 1818,	18¼	12.6	.491	.521
Sequin Fonducli,	53	42.5	1.717	1.831
Yermeebesklek,	73¾	70.3	2.84	3.029
UNITED STATES OF AMERICA				
Eagle coined before July 31, 1834,	270	247.5	10.	10.668
do. coined since July 31, 1834, shares in proportion	258	232.		10.
VENICE.				
Sechino or Sequin—shares in proportion,	54	53.6	2.166	2.31
WURTEMBURG.				
Carolin,	147½	113.7	4.594	4.898
Ducat,	53	51.9	2.097	2.237
ZURICH.				
Ducat, double and half in proportion,	53¾	52.6	2.125	2.267

Note.—Four pennyweights of gold being divided into 24 equal parts, these parts are called carats; but gold is often mixed with some baser metal, which in the mixture is called alloy; and according to the proportion of pure gold which is in every 4 pennyweights, so the mixture is said to be so many carats fine. Thus, if only 20 carats of pure gold and 4 of alloy, it is 20 carats fine; if 22 carats of pure gold and 2 of alloy, 22 carats fine; and if there be no alloy, it is 24 carats fine or pure gold. A carat is 4 grains.

To compute the fineness of any gold coin from the foregoing table.

RULE.

As the weight of the coin, Is to its contents in pure gold, So is 24 carats, To the fineness required.

Examples.

1. The weight of the American Eagle, coined prior to July 31st, 1834, was 270 grains, its contents in pure gold is 247.5 grains—I wish to know how many carats fine it is.

As 270 : 247.5 :: 24 : 22 carats fine. Answer.

2. Required the fineness of the American Eagle coined after July 31st, 1834.

As 258 : 232 :: 24 : 21 carats $2\frac{4}{43}$ grains. Ans.

3. I wish to know the fineness of the Turkish Sequin Fonducli.

As 53 : 42.5 :: 24 : $19\frac{1}{4}$ nearly. Answer.

4. I demand the fineness of the sequin of Rome.

As 52.5 : 52.2 :: 24 : 23.86 carats fine. Ans.

5. Required the fineness of Rupee of Madras.

As 180 : 165 :: 24 : 22 carats fine. Ans.

6. Required the fineness of the Spanish Doubloon.

As 417 : 360.5 :: 24 : $20\frac{3}{4}$ nearly. Answer.

7. I wish to know the fineness of Ruspone of the kingdom of Etruria.

As 161.25 : 161 :: 24 : 23.96 carats fine, or nearly pure gold. Answer.

MISCELLANEOUS QUESTIONS.

1. A hare starts 5 rods before a greyhound, and is not perceived by him until she has been up 34 seconds; she scuds away at the rate of 12 miles an hour, and the greyhound on view makes after her at the rate of 20 miles an hour—How long will the course hold, and what ground will he run, beginning with the outsetting of the greyhound?

Ans. $58\frac{1}{32}$ seconds : $1702\frac{1}{4}$ feet run.

2. A. leaves New Italy at 4 o'clock in the morning for Harrisburg, and goes at the rate of 6 miles an hour, without intermission: B. sets out of Harrisburg for New Italy at 5 o'clock the same morning, and rides at the rate of 5 miles an hour constantly—the question is, whereabouts on the road will they meet, and at what time; the distance being 55 miles? Ans. $32\frac{8}{11}$ miles from Harrisburg, at $27\frac{3}{11}$ min. past 9 in the morning.

3. There is an island which is 36 miles in circumference; now if at the same time and from the same place, two footmen, A and B, set forward to travel round about the said island, and follow one another in such a manner that A travels every day 9 miles and B 7 miles—the question is to find in what space of time they will meet again, and also how many miles, and how many times round the island each footman will then have travelled.

Ans. They will meet at the end of 18 days from their first parting, and then A will have travelled 162 miles, (or $4\frac{1}{2}$ times the circumference of the island) and B will have travelled 126 miles, (or $3\frac{1}{2}$ times the circumference of the island.)

4. An Italian Mulberry orchard in New Italy measures as follows, viz: south side 42.9 perches, west side 37.2 perches, north side 33.4 perches, east side 36.1 perches; the north-east and south-east corners are each a right angle—I wish to know how much longer the diagonal from the north-east to the south-west corner is than that from the north-west to the south-east corner. Ans. 6.89 perches.

5. During the memorable storm of sleet and snow on the 8th and 9th of January, 1836, a tree (near the compiler's door,) 80 feet in height, was broken in such a manner as to touch the ground 60 feet from the foot of the tree—I wish to know the length of the piece broken. Ans. $62\frac{1}{2}$ feet.

Rule for such questions.

Add the square of the height of the tree to the square of the distance from the foot of the tree to the top (after it fell); divide the sum by twice the height of the tree, the quotient will be the length of the broken piece.

6. Required the diameter of a circle that will comprehend within its circumference the quantity of an acre of land.

Ans. 235 ft. 6 in.

7. A may pole 50 ft. 11 in. in length, at a certain hour of the day casts a shadow 98 ft. 6 in. long; I would hereby find the breadth of a river, that, running 20 feet 6 inches from the foot of a steeple, 300 feet 8 inches high, the extremity of the shadow of the steeple reaching 30 feet 9 inches beyond the stream. Ans. 530 ft. 5 in. nearly.

8. If 6 men can perform a piece of work in $4\frac{1}{2}$ days, how many men will accomplish another four times as large in one fourth the time? Ans. 96.

9. A. set out from Lancaster for Philadelphia, at the very same time that B. set out from Philadelphia for Lancaster, distant 62 miles: at 4 hours' end they met on the road, and it then appeared that A. had ridden 1 mile an hour more than B.—At what rate an hour did each of them travel?

Ans. A $8\frac{1}{4}$ miles, B $7\frac{1}{4}$.

10. A father and his son upon a time,
Were laden with some bottles of French wine;
The son unto the father did complain,
That the weight of them his arms did sorely pain;
The father said, if one of yours I take,
My number double unto yours will make,
But if I one of mine to you do give,
As many as you have in all I still shall have—
How many bottles of this wine
Had each of them I pray define?

Ans. Father 7, and son 5.

Note.—A law was passed at the last session of the legislature of Pennsylvania, regulating the standard weight of grain. By weight is undoubtedly the most correct way to arrive at the value of grain. The act of March 10th, 1835, says: "The several kinds of grain hereafter mentioned, which are now usually bought and sold by measure, shall, from and after the passage of this act, be regulated according to the following standard weight per bushel, to wit: the weight of each bushel of barley, 47 pounds; of each bushel of buckwheat, 48 pounds, and of each bushel of oats, 32 pounds: Provided, that nothing in this act contained shall be construed so as to prevent any person or persons selling and buying the several kinds of grain aforesaid by measure."

11. A farmer mixes barley, buckwheat and oats together, so as to have a mixture of 50 bushels that will weigh 42 pounds per bushel—I wish to know the quantity of each kind of grain.

Ans. 28 bu. of barley, 5 of buckwheat and 17 of oats.
Or, 12 of barley, 20 of buckwheat, and 18 of oats.

12. Required the superficies of a board whose mean breadth is 15 inches, and length 16 feet. Ans. 20 feet.

13. Required the quantity of bark in a cart 10 feet long, 3 feet 2.4 inches wide, and 4 feet deep. Ans. 1 cord.

Note.—The solid contents of similar figures are in proportion to each other as the cubes of their similar sides or diameters.

14. If a bullet 8 inches in diameter weighs 64 pounds, what will a bullet of the same metal weigh whose diameter is 2 inches? Ans. 1 pound.

15. If a man drink daily a dram which costs $6\frac{1}{4}$ cents, how much will he expend in this manner in 40 years of $365\frac{1}{4}$ days each? Ans. $913.12\frac{1}{2}$.

16. If a parcel of cloth be sold for $678, and at 13 per cent. gain, what was the prime cost? Ans. $600.

17. Two merchants trade together: A. put into stock $150, and B. $275, they gained $170—What is each person's share? Ans. A. $60; B. $110.

18. If $\frac{3}{16}$ of a ship be worth $6000, what is the worth of the whole? Ans. $32000.

19. A captain and 150 sailors took a prize worth $3000, of which the captain had one-half for his share, and the rest was equally divided among the sailors—What was each man's share? Ans. the captain $1500; and each sailor $10.

20. An ancient lady being asked how old she was, to avoid a direct answer, said, I have 12 children, and there are two years between the birth of each of them; the eldest was born when I was 20 years old, and the youngest is now 25 years old—How old was the lady? Ans. 67 years.

21. If a pound of ginger be sold for 6 cents, and there is 2 cents lost on it, what is the loss per cent.? Ans. 25.

22. A person being asked the hour of the day, said, the time past noon is equal to $\frac{2}{3}$ of the time till midnight—What was the time? Ans. 48 min. past 4.

23. If $\frac{4}{5}$ of an ounce of silver cost $\frac{4}{5}$ of a dollar, what will $\frac{7}{4}$ of a pound cost? Ans. $12.60

24. Twenty knights, 30 merchants, 24 lawyers, and 24 citizens spent at a dinner $192, which sum was divided among them in such a manner that 4 knights paid as much as 5 merchants, 10 merchants as much as 16 lawyers, and 8 lawyers as much as 12 citizens. The question is, to know the sum of money paid by all the knights, also by the merchants, lawyers and citizens.

Ans. The 20 knights paid $60; the 30 merchants, $72; the 24 lawyers, $36; and the 24 citizens $24.

THE END.